The Engineer

LONDON, FRIDAY, AUGUST 15, 1941.

PUBLIC NOTICES

CITY OF SALISBURY

SOUTHERN RHODESIA

TWO 2500 kW. C.M.R. TURBO-ALTERNATORS AND EXCITERS WITH COMPLETE CONDENSING AND AUXILIARY PLANT

Tenders are Invited for the SUPPLY, DELIVERY and ERECTION of the above-mentioned POWER STATION PLANT and EQUIPMENT in accordance with the City Council's specification.

One copy of the specification may be obtained from the Consulting Engineers, Messrs. Merz and McLellan, 32, Victoria Street, London, S.W.1, on or after 18th August on payment to them of a fee of £5 5s.

Additional copies of the specification may be obtained from the Consulting Engineers in London on payment of £2 2s. for each such additional copy.

Sums paid on any number of copies up to four will be refunded on receipt of a bona-fide Tender.

Tenderers are requested to note that issue of a Certificate of Essentiality for the above plant and equipment is assured by the Southern Rhodesia Ministry for Co-ordination of Supplies.

Sealed Tenders with all relative documents, endorsed to indicate the items to which they relate, must be delivered in triplicate as follows :—

(1) Two copies of the original Tender and documents to the Official Secretary, Office of the HIGH COMMISSIONER FOR SOUTHERN RHODESIA, Rhodesia House, 429, Strand, London, W.C.2, not later than 29th September, 1941.

(2) One duplicate Tender and documents to Messrs. MERZ & McLELLAN, 32, Victoria Street, London, S.W.1, not later than 24 hours after deposit of the original Tender and documents with the High Commissioner.

The Council do not bind themselves to accept the lowest or any Tender. 7676

MANCHESTER SHIP CANAL COMPANY

APPOINTMENT OF ASSISTANT TO CHIEF ENGINEER

Applications are Invited for the POSITION of ASSISTANT to the CHIEF ENGINEER, at a commencing salary of £1000 per annum.

Candidates should not exceed 45 years of age, must be Corporate Members of the Institution of Civil Engineers, and be experienced in the Design, Construction, and Maintenance of Dock and Harbour Works.

Applications, stating age, qualifications, and previous experience, should be addressed to the GENERAL MANAGER, MANCHESTER SHIP CANAL COMPANY, SHIP CANAL HOUSE, MANCHESTER, 2, not later than August 25th, 1941. Envelopes to be marked "Personal."

Testimonials need not accompany applications. 7652

THE RIVER GREAT OUSE CATCHMENT BOARD

ENGINEERS

Applications are Invited for the following APPOINTMENTS :—

(A) ASSISTANT ENGINEER, salary £350 per annum.

(B) ENGINEERING ASSISTANT, salary £300 per annum.

Including war bonus.

Applicants for appointment (A) should be Corporate Members of the Institution of Civil Engineers or hold other similar qualification and have good experience in land drainage works, steel and concrete design and the execution of works by contract and direct labour.

Applicants for appointment (B) should have been regularly trained as Civil Engineers, experienced in surveying and levelling and have considerable experience in land drainage work.

Applications on the prescribed form, which will be supplied on receipt of a stamped, addressed, foolscap envelope, must be submitted, together with copies of two recent testimonials, to the undersigned, the envelope being endorsed "Appointment (A) or (B)," as the case may be, on or before Monday, 1st September, 1941.

W. E. DORAN, B.A.I., A.M.I.C.E.,
Engineer to the Board.

"Elmhurst,"
Brooklands Avenue,
Cambridge. 7686

THE TEES VALLEY WATER BOARD

APPOINTMENT OF CIVIL ENGINEERING ASSISTANT

The Tees Valley Water Board (daily supply about 24 million gallons) invite APPLICATIONS for the POST of a CIVIL ENGINEERING ASSISTANT, at salary of £355, rising, subject to satisfactory service, by annual increments of £15 to £400 per annum.

This is an additional appointment to the one recently made.

Applicants must be Associate Members (by examination) of the Institution of Civil Engineers, and have sound technical and practical experience of the duties relating to the administration of a large water undertaking, especially in connection with the design and construction of pressure and rapid gravity filtration works, the installation of steam, electric and diesel-driven pumping plant, chlorination and treatment of water.

It will be an advantage if the applicant has had experience in the maintenance of impounding reservoirs, river intake works, &c.

The person appointed must devote his whole time to the work of the Board.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications, stating age (not to exceed 40 years), qualifications and experience, and accompanied by copies of three recent testimonials, should be sent off as early as possible and reach the undersigned not later than Wednesday, 27th August, 1941, when a "short list" will be prepared of those candidates who will be asked to attend for personal interview on Monday, 8th September, 1941.

T. S. R. WINTER, Assoc. M. Inst. C.E.,
Acting General Manager and Engineer.

Water Board Offices,
Corporation Road,
Middlesbrough,
Yorks. 7682

The Engineer

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PAPER ECONOMY

It has now become necessary, in order to maintain the normal circulation of THE ENGINEER, to print all advertisement pages on the Thin Paper hitherto used for the Foreign Edition.

So long as our diminishing stocks of thick paper will allow, the Home Edition Editorial pages will be printed on the usual paper, so that uniformity in bound volumes may be maintained.

PUBLIC NOTICES

LOWER MEDWAY INTERNAL DRAINAGE BOARD

APPOINTMENT OF ENGINEER

The Board Invites Applications for the POST of ENGINEER. Salary £500-£25-£600 per annum.

Applicants must be Corporate Members of the Institution of Civil Engineers and/or the Institution of Municipal and County Engineers, and preference will be given to those who have been engaged upon works of land drainage, river maintenance, sea defence, including the construction and maintenance of flood and outfall sluices, and the design of reinforced concrete structures. Candidates must also have had experience in works of construction by direct labour or by contract, and will be required to supervise the Board's State-aided land drainage schemes and maintenance works.

The appointment will be subject to the passing of a medical examination and to the provisions of the Local Government Superannuation Act, 1937.

Canvassing, either directly or indirectly, will be a disqualification.

Forms of application may be obtained from the undersigned and must be returned to him not later than Saturday, the 13th September, 1941.

A. C. LL. THOMAS,
Clerk of the Board.

71A, Bank Street,
Maidstone,
12th August, 1941. 7687

PUBLIC NOTICES

ROBERT GORDON'S TECHNICAL COLLEGE, ABERDEEN

ELECTRICAL ENGINEERING DEPARTMENT

Applications are Invited for the POST of HEAD of the ELECTRICAL ENGINEERING DEPARTMENT. Candidates must be University Graduates in Engineering and have had thorough practical training in Electrical Engineering and experience in Lecturing. Salary scale £600 to £650 per annum. The salary covers service in both Day and Evening Classes.

The Engineering Department of the College co-operates with the University of Aberdeen in providing Degree Courses in Engineering. The occupant of the post is normally a part-time lecturer in the Department of Engineering of that University.

Ten copies of letter of application and ten copies of not more than three recent testimonials should be lodged not later than Saturday, 30th August, 1941.

JAMES McKENZIE,
Secretary and Registrar.
7688

TO ADVERTISERS UNDER BOX NUMBERS IN SITUATIONS OPEN SECTION.

For the benefit of applicants, the Proprietors are prepared to insert brief notices that vacancies are filled, upon receipt of notifications from the Advertisers. These notices (limited to one line) will be free of charge, and co-operation is asked for.

PUBLIC NOTICES

UNIVERSITY OF BIRMINGHAM

APPOINTMENT OF GRADE II (b) LECTURER IN THE DEPARTMENT OF MECHANICAL ENGINEERING

Applications are Invited for the POST of GRADE II (b) LECTURER. Stipend £400 per annum. Duties to begin 1st October, 1941.

Four copies of application, together with four copies of not less than three testimonials, must be sent on or before September 6th to the undersigned, from whom further particulars may be obtained.

C. G. BURTON,
Secretary.

The University,
Edmund Street,
Birmingham, 3.
August, 1941. 7680

UNIVERSITY OF MANCHESTER

PHYSICS DEPARTMENT

Full Particulars of the LECTURES and LABORATORY COURSES in PHYSICS, preparing for both the Ordinary and Honours Degrees, will be forwarded on application to the REGISTRAR.

The SESSION COMMENCES on THURSDAY, SEPTEMBER 25th. 7664

UNIVERSITY OF LONDON

KING'S COLLEGE

FACULTY OF ENGINEERING.
CIVIL, MECHANICAL, ELECTRICAL and CHEMICAL ENGINEERING.

Complete Courses of Study, extending over three years, are arranged for the Engineering Degrees of the University of London and/or for the Diploma and Certificate of the College.

DEPARTMENT OF CIVIL AND MECHANICAL ENGINEERING.

Professor of Civil Engineering and Dean of the Faculty :—
C. H. LOBBAN, D.Sc., M. Inst. C.E.

Professor of Mechanical Engineering :—
S. J. DAVIES, D.Sc., Ph.D., Wh.Ex., M.I. Mech. E.

DEPARTMENT of ELECTRICAL ENGINEERING.

Siemens Professor of Electrical Engineering :—
J. K. CATTERSON-SMITH, M.Eng., M.I.E.E.

DEPARTMENT OF CHEMICAL ENGINEERING.
(Discontinued during the War.)

POST-GRADUATE COURSES and facilities for Research are provided in each of the above Departments, which are fully equipped with modern plant and apparatus.

For full information and prospectus apply to the SECRETARY, KING'S COLLEGE, LONDON, at the University, BRISTOL, 8. 7672

HERIOT-WATT COLLEGE

EDINBURGH

The Governors Invite Applications from British subjects for the following POSTS :—

MECHANICAL ENGINEERING DEPARTMENT.—LECTURER in GENERAL ENGINEERING SUBJECTS with laboratory experience; special experience of workshop production and methods will be a recommendation.

ELECTRICAL ENGINEERING DEPARTMENT.—LECTURER with special experience in radio engineering.

Teaching experience is essential. Salary scale £300-£15-£500. Candidates may be placed on the scale according to qualifications and experience.

Applications must be made on forms to be obtained with full particulars from the College not later than 30th August.

J. CAMERON SMAIL,
7679 Principal.

Liquidation Stock. — The LIQUIDATOR of SODAX (1929), Limited, invites TENDERS for the GOODWILL and STOCK of the Company, comprising approximately 4000 Small Aerating Machines, 200 Carbon Dioxide Cylinders, 85 Gross Screw-stoppered Bottles, a Quantity of Flavours and Essences and other accessories. Full details may be had on application to the Liquidator, J. L. Vann, F.C.A., of 6, Wardrobe Place, E.C.4, and inspection can be arranged by appointment. Tenders should be addressed to the LIQUIDATOR at 6, Wardrobe Place, London, E.C.4, in an envelope marked "Sodax Tender," and will be opened by him on Tuesday, 26th August, at 12 noon. The Liquidator does not bind himself to accept the highest or any Tender. 7678

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CLASSIFIED ADVERTISEMENTS CLOSE FOR

PRESS—NOON WEDNESDAYS

The Engineer

Annual Subscription Rates

(including postal charges).

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CANADA	£3 3 0	Thick Paper Ed.
	£2 18 6	Thin Paper Ed.
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(except Canada)	£3 3 0	Thin Paper Ed.

"THE METALLURGIST."

This Supplement, which deals with the Science and Practice of Metallurgy, both ferrous and non-ferrous, is published free with the last issue of THE ENGINEER each alternate month. Next date, August 29th.

ADVERTISEMENTS.

The charges for Classified Advertisements are 1/- per line up to one inch—minimum charge 4/-; those occupying one inch or more at the rate of 12/- per inch. Orders must be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o'clock on Wednesday afternoon.

Letters relating to the Advertisement and the Publishing Departments of the Paper are to be addressed to the Publisher, all other letters are to be addressed to the Editor of THE ENGINEER.

Postal Address, 28, Essex Street, Strand, London, W.C.2.

Teleg. Address, "Engineer Newspaper, Estrand, London." Tel., Central 6565 (10 lines).

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

IMPORTANT

Advertisers in Situations Open Column should make themselves acquainted with the terms of

STATUTORY RULES & ORDERS 1940 No. 877

RESTRICTION ON ENGAGEMENT ORDER

WANTED FOR ABROAD.—APPLICATIONS are INVITED for fully qualified men to fill the undernoted POSITIONS in an important Iron and Steel Works situated abroad :—
MELTING SHOP MANAGER.
ROLL DESIGNER.
STEEL WORKS CHEMIST.
Address, stating full details of education, training, experience, positions occupied in iron and steel works, salary required, &c., 7685, The Engineer Office. 7685 A

ENGINEERING PUBLICITY.—ASSISTANT to PUBLICITY MANAGER REQUIRED (man or woman) by Midland Engineering Firm. Knowledge of Advertisement Lay-out, Block Buying and Catalogue Production.—Address, stating particulars of experience, age and salary required, 7677, The Engineer Office. 7677 A

MANAGER, to Take Charge of Power Press and Sheet Metal Machinery Sales Department, both new and second-hand. Practical executive experience essential, knowledge of design an advantage. Permanent progressive position for right man.—Address, giving full details and salary required, 7675, The Engineer Office. 7675 A

MATERIAL CONTROLLER REQUIRED. Must be man of exceptional experience and energy with outstanding organising ability. Complete knowledge of works systems as applied to planning, progressing, stores, scheduling, and sub-contracting in large engineering companies. The vacancy will carry a salary appropriate to the responsibility.—Address, P3447, The Engineer Office. P3447 A

OFFICE PROPERTY, CITY OF LONDON.—ASSISTANT REQUIRED for General Estate Office Routine. Preference to one capable of supervising maintenance, including Boiler-house Plant. Salary £250 to £300, according to experience.—Write Box "W.V.," c/o, 95, Bishopsgate, E.C.2. P3437 A

REPRESENTATIVE REQUIRED in the Midlands to Handle Contractors' Plant (Excavators, Dumpers, Cranes, Mixers, &c.). Particulars of salary expected, experience, &c.—Address, 7689, The Engineer Office. 7689 A

THE Post You Are Seeking May Not be Advertised in this Column, but do not lose the Opportunity of Bringing Your Requirements before all those who would be interested and could employ you. An Advertisement in the "Situations Wanted" Columns would be seen by all Leading Engineering Concerns for a cost of Four Lines, 4s.; 1s. for each Additional Line. There is no better way of covering so large a field for such a small charge.

TURBINE DRIVER, Experienced in Operation of modern Turbo-Alternator Units for permanent APPOINTMENT in Home Counties. Present wages £4 1s. per week of six 8-hour shifts, rising to £4 11s. per week. Pension scheme.—Address, stating age, experience and enclosing copies of testimonials, P3422, The Engineer Office. P3422 A

WELL-KNOWN CONTRACTORS REQUIRE AGENT to Take Charge of Reconstruction Work in North-West District. Good scope for fully experienced man. Able to supervise men.—Address, 7586, The Engineer Office. 7586 A

CHIEF DRAUGHTSMAN REQUIRED for Mechanical Engineer's Department of Chilian Railway. Three years' contract, salary £500-£550 p.a., according to experience. Free single or married quarters and passages out and home.—Write, stating details of training and experience, if single or married, and age, to Box "J.C.," c/o 95, Bishopsgate, London, E.C.2. P3440 A

SITUATIONS WANTED

ACCOUNTANT MANAGER (37), Fully Qualified and experienced in large companies, expert Government contracts, costing works and staff organisation, shortly free for EXECUTIVE POSITION; first-class connections.—Address, P3450, The Engineer Office. P3450 B

CIVIL ENGINEER, A.M.I.C.E., M.I.M.E., DESIRES CHANGE. Experience railways, factory lay-out, surveying; wide mechanical knowledge. Salary £1000.—Address, P3452, The Engineer Office. P3452 B

For continuation of Small Advertisements see page 68

WALKER'S LION PACKING

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NATIONAL EMERGENCY!

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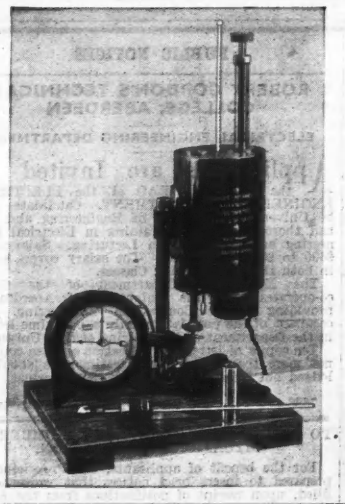
The Engineer

WAR EMERGENCY DIRECTORY 1941

A strictly limited number of copies of the above has been printed. The booklet on this occasion contains only the names of Firms with their present addresses, telephone numbers and telegraphic addresses. It is believed that this will serve a useful purpose and applications for copies will be dealt with in rotation.

Write to— **The Manager, "THE ENGINEER," 28, Essex Street, Strand, London, W.C.2**



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See Advt. — "Engineer" — Aug. 1

ENGINEER HOME GUARDS!

Do YOU know—

What pressure is developed in a rifle barrel when a round is fired?

What effect air resistance has on the flight of the bullet?

How fast a bullet should spin to to attain steadiness in flight?

Why a rifle fires high in wet weather?

What is the cause of "drift"?

How to calculate the energy of recoil?

What is the effect of "whipping vibration"?

•

Answers to these and many other questions are to be found in :—

FACTS ABOUT THE RIFLE

by DAVID WEIR, B.SC.

(Reprinted from articles in "THE ENGINEER").

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28, ESSEX STREET, STRAND,
LONDON, W.C.2.

The Engineer

ENQUIRY DEPARTMENT

The fact that our Enquiry Department is unquestionably filling a want in the engineering world daily becomes more apparent, and the Proprietors of "The Engineer" welcome enquiries from all who require information of a technical or commercial nature.

This Department contains an extensive trade name index, a large technical library, and catalogues of most of the prominent manufacturers.

A Seven-Day Journal

A Proposed Tyne Tunnel

ON Thursday, August 7th, plans for a tunnel under the River Tyne in the neighbourhood of the existing Jarrow-Howden ferry were adopted by the Northumberland County Council. The scheme has been prepared by Messrs. Mott, Hay and Anderson, of Westminster, and the cost is approximately £1,950,000. As, however, construction cannot be begun until after the end of the war, post-war costs which cannot be predicted may affect the figure given. On the north side of the river the plan includes the construction of an approach road with two bridges under the L.N.E.R. lines, while on the south side of the river an existing road will be widened. The approach roads on both sides are planned with a total width of 80ft. in built-up areas, and where the ground is open provision has been made for twin roads, each with a 22ft. carriageway, a 9ft. cycle track and a 6ft. footpath. The main tunnel has a road width of 21ft. and it is proposed to drive this tunnel at such a depth as will allow the river to be dredged to a depth of 50ft. below the low-water level. It is further suggested that pedestrians and cyclists should be accommodated in a separate tunnel having a diameter of 15ft. The proposal has been considered by a joint committee representing the Durham and Northumberland County Councils, and the report of that committee was submitted to the Northumberland County Council at Thursday's meeting. The joint committee reports that, at the present time, it is hardly possible to make any active progress with a scheme of this kind, but among the preliminary steps which it thinks may be properly taken with a view to minimising post-war delays is the making of the necessary inquiries to ascertain whether priority can be obtained for the promotion of a parliamentary Bill after the war.

Sir Alan Anderson's Appointment

IN reply to a question in the House of Commons on Thursday, August 7th, Colonel Llewellin, the Parliamentary Secretary of the Ministry of War Transport, said that the Minister had accepted with regret the resignation of Sir Ralph Wedgwood, C.B., C.M.G., from the chairmanship of the Railway Executive Committee, a position which he had held since the formation of that Committee on the outbreak of war. Colonel Llewellin then announced that the Ministry had been able to secure the services of Sir Alan Anderson, G.B.E., as Chairman of the Railway Executive. Sir Alan will also hold the post of Controller of Railways in the Ministry of War Transport. On his new appointment Sir Alan Anderson has resigned from the board of the London Midland and Scottish Railway Company. Sir James Milne, who is at present a member of the Railway Executive Committee, has been appointed Deputy Chairman. Sir Alan Anderson has expressed the wish to give his services to the war effort, and the position which formerly carried salary will not now do so. In explaining the policy of the Government with regard to the railways, Colonel Llewellin went on to say that during the war the Ministry of War Transport was in control of the railway companies. It was endeavouring, through the Railway Executive Committee and through its new Chairman, who will be Controller of Railways, to see that the railway companies worked together and gave the best service to the country.

War Damage Payments

NEW and important measures for the safeguarding of the public interest in the making of war damage payments, having special regard to town and country planning, are set forth in a memorandum which has been recently sent by the Minister of Health and the Secretary of State for Scotland, on behalf of the War Damage Commission, to all local authorities, and joint town and country planning committees and boards. The memorandum deals with the general provisions of the War Damage Act, Part I, and particularly the modifications under Section 7 of the Act, which the Commission is empowered to make in order to safeguard public interest. The Commission states that as a first step it contemplates the specification of classes of work in the form of "all works which cost more than a certain sum in a certain area, and the imposition of an obligation on any person proposing to execute any works so specified to submit their proposals." It is further proposed that the prescribed sum for the purpose of this formula shall be £1000 or ten times the annual net value of the hereditament, whichever is the less. In relation to this money limit, it is proposed that the areas should be coterminous with local government areas, provided that if there are any wards, parishes or other recognised local government sub-divisions, in which there has been no war damage, or no appreciable war damage, such areas might be excluded. In addition the Commission contemplates prescribing certain smaller areas, either within or without the local government areas covered by the specification of "works" referred to above, in which an obligation will be imposed to submit proposals for all works other than temporary works. This procedure would be limited to those areas where the degree of damage, the nature of the property and the need for replanning in detail make it desirable to exercise the fullest measure of control. The local authorities are invited to make suggestions to the War Damage Commission for the specification of works or areas within their boundaries. A separate circular is being issued by the Ministry of War Transport on behalf of the War Damage Commission to highway authorities, dealing with the applications of Section 7 of the War Damage Act to highways.

Naval and Mercantile Shipbuilding in Canada

SOME interesting facts concerning the progress made with Canada's naval and mercantile shipbuilding programme were given by Mr. Angus Macdonald, the Canadian Minister for Naval Services, who arrived in this country on Saturday, August 9th, after crossing the Atlantic Ocean in a bomber. He said that the Royal Canadian Navy had made an astonishing growth since the outbreak of war. At the beginning of the war it comprised only thirteen ships with 1774 officers and men on active service. To-day, in the same Navy, there were approximately 250 ships, with 22,000 officers and men. These ships included three armed merchant cruisers, thirteen destroyers, besides corvettes, minesweepers and smaller craft. As already recorded in these columns, naval construction in Canada is now in full swing, and corvettes are being built mostly on the Great Lakes. Soon the construction of destroyers is to be begun, and for this purpose skilled supervisors are to be lent by Great Britain. Mr. Macdonald revealed that when the Third Canadian Division recently left Canada for Britain the destroyer escort which accompanied the convoy was composed equally of British and Canadian vessels. The new shipbuilding programme, which was started last year, will produce, it is expected, about 1,000,000 tons of cargo shipping next year, and more than that amount in the following year. The merchant shipbuilding programme which was begun early this summer was, Mr. Macdonald said, well advanced, and the first ship is to be ready before the end of the present year. In 1942 it is expected to launch and complete 100 new merchant ships. The Royal Canadian Navy was, Mr. Macdonald added, capable of being disposed to the best advantage in both the Atlantic and the Pacific oceans. Several ships are already in the Pacific, which has an important naval base at Esquimalt. Through the Joint Defence Board Canada and the United States of America, were now co-operating in hemisphere defence.

An L.N.E.R. Engineering Appointment

IT is announced by the London and North-Eastern Railway that Mr. W. Y. Sandeman, M.C., B.Sc., M. Inst. C.E., Assistant Engineer of the L.N.E.R. Southern Area, has been appointed Engineer, Scottish Area, in succession to Mr. J. C. L. Train, who recently became Engineer, Southern Area. Mr. Sandeman served his apprenticeship with a firm of consulting engineers in Edinburgh, and joined the engineering staff of the former North British Railway in 1913 as an assistant in the Maintenance Department. He left that position in 1915 in order to become an Assistant Engineer to the Port of London Authority and had charge of constructional work at Victoria Dock. A few months later he received a commission in the Royal Engineers and served with a Field Company in France until the end of the war, being awarded the Military Cross in the New Year honours of 1918. After the war ended he rejoined the North British Railway Company as an assistant in the parliamentary and Constructional Department and was appointed Assistant-in-Charge of that Department of the Scottish Area of the L.N.E.R. in 1925. Three years later Mr. Sandeman was promoted to the post of District Engineer, Northern District, Scottish Area, and in 1935 was transferred to Glasgow to take charge of the Western District. In February, 1937, he left Scotland to become Assistant to Engineer (General) of the L.N.E.R. Southern Area, being appointed Assistant Engineer in 1938, the post he now vacates for his new appointment.

Employment Returns

IT was officially announced by the Ministry of Labour and National Service on Monday, August 11th, that the number of men and boys registered at Employment Exchanges in Great Britain as wholly unemployed at July 14th was 113,662, a decrease of 7900 as compared with June 16th. Of this total, 33,048 had been classified by interviewing panels as unsuitable for ordinary industrial employment. Those registered as on short time or otherwise temporarily suspended from work on the understanding that they were shortly to return to their former employment numbered 20,862; this was an increase of 2816 as compared with June 16th. Those registered as unemployed casual workers, being persons who normally seek their livelihood by jobs of short duration, numbered 11,005, an increase of 1202 as compared with June 16th. The corresponding figures for women and girls at July 14th were 105,915 wholly unemployed (of whom 3814 had been classified by interviewing panels as unsuitable for normal full-time employment and 4658 classified as unable for good cause to transfer to another area, although employment was not likely to be available locally), 25,165 temporarily stopped and 671 unemployed casual workers. As compared with June 16th, the numbers wholly unemployed showed a decrease of 16,179, those temporarily stopped a decrease of 4522, and unemployed casual workers a decrease of 76. A table showing the difference between June 16th, 1941, and July 14th, 1941, indicates that there has been a reduction in the number of unemployed persons in all the administrative divisions. The largest decreases are those for the North-Eastern Division, 4915; the London Division, 3369; the Northern Division, 3686; and the North-Western Division, 3139. Reductions of well over a thousand were recorded in all the other divisions with the exception of Wales, in which the reduction was 432 persons.

German Power Stations Bombed

IN daylight on Tuesday, August 12th, the Royal Air Force carried out one of the most intensive attacks on important electrical power stations in the Rhineland. According to the Air Ministry statement on Tuesday evening, six squadrons of Blenheim bombers of the Bomber Command penetrated into the Rhine area to attack the great power stations near to Cologne, Goldenberg near Knapsack, and the Fortuna stations, not far from Quadrath. These stations are steam stations and are in the lignite fuel area. The Goldenberg power station has a designed output of over 400,000 kW, while the output of the Fortuna stations is about 200,000 kW. Our bomber squadrons were accompanied by fighters as far as Antwerp and then proceeded alone, flying often at heights less than 100ft. on their 150 miles penetration of the German defence system. Both power stations were attacked at 11.30 a.m. at point-blank range. It is reported that a great number of bombs scored direct hits on the turbine and boiler-houses and that the targets were left in flames. The returning bombers were met near Antwerp by a strong force of fighters, which covered their withdrawal across the North Sea, while another strong force of fighters patrolled the Dutch coast in support. At the same time Hampden bombers were engaged in attacking the railway systems near to St. Omer and a power station near Gosnay in the Pas de Calais. The bombers were escorted by fighters and three enemy fighters were destroyed by the escorting fighters. At the same time "Fortress" aircraft were attacking the aerodrome near De Kooy, as well as objectives at Cologne and the port of Emden. On Monday night machines of the Bomber Command attacked important military objectives, including some smaller power stations at Krefeld, Rheydt and München-Gladbach, in Western Germany. Our losses in all Tuesday's operations were twelve Blenheim bombers and eight fighters.

Trent Catchment Board

DURING last week-end an official visit was paid by the Minister of Agriculture, Mr. R. S. Hudson, to the Nottinghamshire district, where works of the Trent Catchment Board and other drainage authorities were inspected. Those who accompanied Mr. Hudson included Mr. H. A. McCulloch, of the Ministry; Captain Crookshank; Mr. H. German, the Chairman of the Trent Catchment Board; and Mr. W. H. Haile, its engineer. The inspection was begun near Bawtry, where, as announced on Thursday last week, the Board is to reverse the flow of the River Idle, a Trent tributary, which with a pumping station in the Everton Carr district should bring into cultivation about 7000 acres on the south bank of the river in the Everton district. Bull Hassocks was also inspected, where 3000 acres of land have already been reclaimed. Since March last 700 acres have been brought under cultivation and the rest of the land is to be prepared for next year's crops. At Candy Farm Mr. Hudson saw a further 1000 acres which have been reclaimed from perpetually wet land, and are now seen under crops for the first time. The works in the Isle of Axholme, which the Catchment Board is carrying out, were also inspected. The whole programme of the Board includes the improvement of about 15,000 acres, a quarter of which are at present waterlogged. Greatly modernised pumping plant and highly banked internal drains are now solving the flooding problem, which, we may recall, in 1932 brought over 23,000 acres of land in this particular area under water. On leaving Nottingham Mr. Hudson congratulated Mr. H. German, the Chairman of the Trent Catchment Board, and Mr. W. H. Haile, M. Inst. C.E., the Board's Engineer, on the excellent work which had been done and was in course of completion.

Industries of the Far East

By Professor C. A. MIDDLETON SMITH

FRENCH INDO-CHINA

THE dramatic events which have taken place in the Far East during the last few weeks have made newspaper readers familiar with the geography, and political divisions, of the vast areas of land in South-East Asia, which are now threatened with war. Very little seems to have appeared in print concerning the great natural resources of these lands, although it is obvious that the fundamental reason for the struggle for political control or influence in Indo-China, Thailand, Dutch East Indies, Malaya and Burma is the desire of the Japanese to obtain the natural resources and trade of these regions.

Engineers believe that it is only by the utilisation of the natural resources available to mankind that the appalling poverty and hunger, which seems always to have cursed large numbers of the human race, can be greatly reduced, if not altogether eliminated. They are therefore especially interested in those countries where there are known to be large stores of undeveloped minerals, water power, and vegetation. There can be no doubt that it was the quest for wealth which attracted the Portuguese, Spanish, Dutch and British merchant adventurers of the sixteenth century to Malaya and "the Spice Islands"—the latter now a great sprawling empire of the Dutch, whose 20,000 islands cover a sea area in the Tropics wider than the whole of the United States. The islands are inhabited by some 65,000,000 happy brown natives, and 250,000 contented white people. For five years the island of Java, the most developed of all these Dutch islands, was British, and Sir Stamford Raffles, a great pioneer of our Empire in the Far East, was Lieutenant-Governor of it in 1812. Raffles wrote to the Foreign Office in London, extolling the value to Britain of Java's rich natural resources, but the folly of a Foreign Office clerk in London made history, for the letter from Raffles was pigeon-holed and found in a corner years after the island had been returned, almost casually, to the Dutch. But Britain, to-day, has responsibilities in the Malayan islands; the flag flies in Borneo and New Guinea, as well as in Malaya and Burma.

The occupation of bases in Indo-China by the Japanese has threatened these countries, and Western China, with attack from a Power which has not disguised its ambition to control the natural resources of South-Eastern Asia. It must be difficult for the reader who has not visited Indo-China to realise why this land was called "the pearl of all French Colonial possessions." For although France had quite a number of colonies, her people attached the greatest importance to Indo-China. But if the colony could be called "a pearl," it was an unpolished pearl; and there can be no doubt that it is the intention of the Japanese to do the polishing as soon as they think it safe to set to work. In other words, so far this region has remained solely a source of supply of materials and food for France, as well as a market for French merchandise. The Japanese intend to use it for that purpose and also to develop industries. Hitherto agricultural products have occupied three-fourths of the entire volume of the export trade of Indo-China, the most important being rice. Great credit is due to French engineers for admirable reclamation and irrigation schemes, with the result that the rice fields have doubled in acreage during the past thirty years. The principal rice-producing districts are the plains of Cambodia, in the basin of the Mekong River, and in all the deltas of the Mekong and other rivers. In some districts there are two, in some cases three, rice crops a year. Food is a fundamental need for the many millions in the Far East, and the supply has seldom been sufficient to prevent starvation of large numbers of people in that part of the world. But reclamations, improved irrigation schemes and other aids to increased production, which can be provided by trained scientists, might easily increase the rice production of this area to three or four times the recent output.

MINERALS IN INDO-CHINA

Next to agriculture mining is the most important industry in Indo-China. It was carried on in a rather primitive manner by the Annamese and Chinese before the French obtained control of the country. But since the introduction of French capital mining has been developed with modern equipment. The most important mineral is coal; Hongay anthracite is one of the best of its kind in the world. There are also deposits of tin, zinc, lead, iron, copper, manganese, antimony, gold, silver, tungsten and precious stones, but the region seems to lack petroleum. No doubt it is the rice, rubber and coal that the Japanese will send to Japan at once; but they are also after other minerals they badly need.

Experts say that Indo-China is admirably suited for rubber cultivation and there is every possibility that the rubber industry may attain a phenomenal development. But the immediate "loot" for Japanese industry is the valuable anthracite coal in Tongking. The deposits form extensive and thick layers near the surface of the ground. The mines are situated near to the sea coast and rivers and so transport facilities are assured. All estimates show that the coal deposits are huge. The writer can vouch for the high quality of Hongay anthracite, which he used for many years. Mixed with the bituminous coal from Japan, it burns well under boilers; it is useful for gas producers and for industries where coal of high calorific value is needed. Next to coal, tin is the most important mineral product of Indo-China. Practically all of the tin ore mined was transported to Malaya to be refined there and then put on to the world market. It will now go to Japan.

Zinc is found in Tongking, where the ore contains about 40 per cent. of zinc on the average. Around 1926 the output exceeded 25,000 metric tons a year, but the figure has been greatly reduced of late, although no doubt the Japanese will increase the output as quickly as possible. They will also develop the ores containing antimony and manganese.

TIN FROM SOUTH-EASTERN ASIA

World production of tin in June this year is estimated at 27,700 long tons, as compared with 22,900 tons in May. Let us examine the statistics of production of the various countries—nearly all in the South Pacific—for May last. We see that Malaya produced 8243 tons; next on the list comes the Dutch East Indies with 4935 tons. Then Bolivia with 3531 tons. Thailand (formerly Siam) produced 1075 tons. Owing to political difficulties the production from Indo-China was, in May last, negligible; but under the International Tin Agreement that country was entitled to produce 1588 tons. United States deliveries totalled 14,880 tons in June, while the tin consumption of the United Kingdom was 14,436 tons for the first six months of the present year.

A study of statistics shows that from 1801 to 1805 the world production of tin averaged 8300 long tons, of which China, Malaya and the Dutch East Indies supplied 5387 tons. In 1851 world production was 18,400 tons; China produced only 500 tons, but Malaya's figure was 6000 tons and the Dutch East Indies produced 5463 tons. In 1901 the total production of tin was 92,900 tons; Malaya's figure increased to 47,475 tons with the Dutch East Indies next on the list with 15,777 tons. Siam figures in the list with 3900 tons and China produced 3044 tons. In 1937 world production rose to 208,200 tons, and as the market price of tin in that year was about £242 a ton, the total value of the tin then produced was no less than £50,000,000. The last year for which consumption figures are available to the writer relate to 1936; in that year the United States consumed no less than 45 per cent. of the world supply. The tinplate industry alone consumed a good 37 per cent. of total world production of this metal. A great deal of tinplate is needed for the preservation of food. It would not be easy to find a substitute for tin in preparing solder and alloys used in the engineering industry.

There is a mineralised belt in which tin ore deposits appear in S.E. Asia. This runs through Burma, Thailand, Malaya and the Dutch East Indies. It is known that this mineralised belt extends along the east coast of Sumatra; this coast is largely covered with dense and impenetrable jungle, but no doubt there will soon be more detailed exploring of this region by geologists. During a tour through S.E. Asia, which the writer made two years ago, he saw alluvial tin ore being extracted by hand, the labourers being Chinese. He also saw the complete mechanisation of the industry produced by the introduction of bucket dredgers, which almost entirely eliminate hand work. A dredger, run by 150 men working on three shifts of eight hours each, moves as much material as was previously moved by four to five thousand workmen. One result of this mechanisation has been a considerable reduction in the demand for labour, and in immigration from China, into these countries in S.E. Asia. The dredgers float on a pontoon; they include facilities for washing the ore mechanically on jigs and concentrating tables. Modern methods of tin mining have greatly reduced the price of production; it was noticeable that many mining districts, where the mines had been abandoned, had been opened up again by the installation of dredgers. Mechanisation has a great advantage over hand labour in these days of restricted production and quotas, as it permits of great elasticity into a business. It is comparatively easy to shut down a part of the works for a time when there is no big labour force to consider.

WORK THAT IS WORTH DOING

As we visited places in Indo-China we had the thrill which the ordinary tourist must miss, an excitement made possible by our thoughts about engineering work of the past and the future in this and the adjoining countries, and how applied science has affected their economic and political development. We thought of the rather depressing final conclusions of Sir Alfred Ewing, who had been instrumental in training the Japanese in engineering science, and who at the end of his life seemed almost to regret the progress that had been made in mechanisation because men have used the new knowledge to destroy one another. He would be even more depressed if he were alive to-day; he would realise that only by their advance in scientific work have the Japanese been able to invade Indo-China; and only because they want the raw materials of S.E. Asia for their mechanised factories are they seeking to control the tin mines, the forests and other products of these tropical regions. And yet there is another and more hopeful side to the picture. After Ewing had made his depressing public statements, about the misuse of applied science, the writer tried to convince him that, on balance, mankind had gained enormously because of the new knowledge, despite the terrible casualties of the first world war. "After all, there were more casualties during the Taiping Rebellion in China in the 1850's than in Europe in 1914–18," was my answer to him; that was followed up with statistics about the average annual casualties caused by famine and floods in the Far East every year. A governor in India is reported as saying that 700 million sufferers are attacked every year by one tropical disease—malaria. Given the opportunities, engineers can enormously reduce the casualties in these tropical lands. We cannot lose faith in the fact that, in spite of the muddles and the neglect of people who control the destiny of nations, in spite of the well-meaning, but clever-ignorant people with no knowledge of science, men who have been deceived by our enemies and who failed to realise our dangers, in spite of all these things some of us are still convinced that we have no need to apologise for our profession, no need to regret our endeavours to lift the burden of work from the shoulders of men on to the iron backs of machinery. Ewing only smiled when reminded that the native driver of a motor-car in the Far East had an easier and more healthy life than the rickshaw coolie or those who, in the Far East, carry humans about in chairs for miles.

Perhaps it was his work in room "X" that revealed to him a really evil side in human nature; perhaps, as we grow older, we lose the hopeful outlook that carried us through many a trial and disappointment in our younger days. Perhaps it has been my good fortune in meeting engineers of different nationalities in the Far East, men who sincerely believed that their work was helping to improve the lot of others; perhaps it was the optimism of these men that made me disagree with Ewing; Todd and others fighting floods in China, under dangerous and difficult conditions; French engineers in Indo-China engaged on reclamation work in isolated and unhealthy country, men who reminded us of the terrible death roll of those who built the railway from the sea coast up through the Nanti valley to Kumming in China; the Dutch engineers who told us of their adventures and trials when they were building the splendid harbour works in different parts of the Far East—these were the men who had found an interest in life and who believed that their work had improved the lot of others.

There comes to my mind vividly a conversation with a young Chinese engineer who was engaged on the survey for the railway that is to supplement the now famous Burma Road. He was worn out by months of hard work; he should have been in hospital, for he had a bad type of malaria on him; but when my suggestion of sick leave was made he simply replied: "We Chinese must win the war and we are short of engineers." His pay was disgracefully poor; before him was the prospect of months in the mountains or jungle and attack by Japanese aeroplanes; but with the tenacity of his race he went on with his job. And so, it seems to me, that even in the midst of the awful crimes against humanity in which the Japanese and their friends are involved, there is no need for engineers to despair; they can still cling to the ideals that carried Watt, Faraday and the men who built industrial Britain to final success. There are engineers in all five continents who have done good work because they have believed in the value of their work to others.

The Engineer in Thailand

South-Eastern Asia will, in due course, be transformed by applied science, just as North America and other lands that possessed useful natural resources have been transformed. As you see the bad conditions under which millions of Asiatics are living to-day, in rich but undeveloped lands, you feel the urge which disorder, ignorance and superstition creates in the mind of anyone trained in a scientific laboratory.

Two years ago an Australian mining engineer told me in Bangkok of his life in Thailand. He had been prospecting in out-of-the-way parts of the country for minerals. He was convinced that only the surface of the deposits of mineral wealth in Thailand had been scratched. Yet there were forty-four foreign tin mining companies registered in Thailand and they only represented about 10 per cent. of the mining community of the country. Many of the mines are poorly equipped from lack of capital and they are worked without much technical knowledge. There were, two years ago, about forty dredgers operating in Thailand. All of the ore was shipped to Malaya for smelting.

Tin production was limited by international agreement, the quota for Thailand being fixed at 18,500 tons for the five years 1937–41. The previous quota was only 9800 tons, so that the Thais did well for themselves in the new agreement.

In the industry you will find European, Chinese, Malay and Indian miners at work; the Thais do not seem to concern themselves much with mining, except to tax the output of ores. In all these S.E. Asia countries the Chinese swarm; they are the traders, shopkeepers, manual workers, &c., for the natives are not energetic; the Thais have always been agriculturists and no doubt the climate, tropical with high humidity, tends to loosen the fibre of determination and to encourage lassitude. Although the Thais formerly came from Szechwan Province in Western China, they drifted down the river valleys into Burma, Siam and Indo-China, finally settling in what is now called Thailand. They mixed with and submerged the Khmer as well as other forgotten peoples. They settled in a land of natural plenty in which people can scarcely starve.

The more energetic Chinese in these tropical lands, in nearly all cases, arrived as penniless labourers, but they soon acquired wealth. They had no knowledge of applied science or modern economics, and so the initiative for engineering and large-scale industries came from Europeans, Americans, Australians and all white men being included, as is usual in the Far East, in the term "Europeans." But there is now a generation of Chinese and other natives who have had a scientific training, although it is unlikely that they will have the experience or the capital needed to make full use of the minerals and vegetation of these lands.

The Chinese have swarmed into Thailand by the thousand, in recent years, for the purpose of planting rubber, which is now of great importance for the economic welfare of the nation. Siamese teak is famous; most of the large teak companies have been owned by Europeans, but the Government has refused, in late years, to renew the forest leases of European companies. Some time ago, at the request of the Siamese Government, the writer conducted a series of tests to tabulate the physical properties of timbers from their forests. He is convinced that there are several other woods, besides teak, that can be supplied for industries from Thailand.

Communications in Thailand

In a few years ways of transportation in Thailand have changed from the elephant, the ox cart, the footpath and the canoe to the motor-car, the railway, the aeroplane and the ocean liner, but you can still see the primitive methods used in many parts of the country. Bangkok is called the Venice of the Orient because of the extensive canal system. We thought it unhealthy; it seemed to need a ruthless attack by public health officials and municipal engineers. Parts of it were pleasant, but we felt the urge to clean it up. There is a great opportunity for port development in Bangkok and its approaches from the ocean.

The railway system of Thailand is one of the best in the Far East. It is joined to the lines in Malaya. Air conditioned and refrigerator cars have improved the comfort of travellers and made possible the transport of fruits and vegetables over long distances. There is a great need for improvements and extensions in the roads; there is a vast productive hinterland that has no markets because of poor communications. As the roads come, wheeled vehicles appear. There are not many privately owned motor-cars, but many bicycles, ramshackle omnibuses and three-wheel cycle taxis. The telephone is widely used in Bangkok, but outside the city it is scarcely known. Telegrams can be sent from almost any town to any part of the world. There is radio telephone connection with Japan and with Europe.

The Future Developments

We saw the great contrast between the engineering and economic developments in Malaya and in those adjoining countries of Thailand and Indo-China. It is a thorny subject, this problem of the lethargy of the "backward races," and the utilisation of the rich natural resources in the lands they inhabit. The engineer who travels through them and sees the many opportunities to create wealth and to improve health and living conditions for the natives, becomes impatient and critical of Governments, politicians and the parasites who oppose engineering works so that they may continue to rake in their ill-gotten revenues. So much could be done if these lands had the efficient Civil Service and guarantees for private enterprise that have created prosperity in Malaya. All that we can do is to watch closely developments in these huge areas in South-East Asia. Can we hope for some sort of federation between the British Empire, the United States and the Dutch for the purpose of making good use of the vast natural resources of these lands? There will be plenty of work for thousands of engineers if the conditions existing in Malaya can be guaranteed all over South-East Asia. We cannot allow the Japanese to squeeze Europeans out of these lands as they have done in Manchuria.

British Engineering Production

(Contributed)

THE recent discussions in Parliament on matters relating to engineering production have been of an intensity reminiscent of the great boiler controversy which raged in the House of Commons at the time of the introduction of the naval water-tube boiler. In the case of the boiler controversy, certain Members of Parliament who were themselves marine engineers took a prominent part. The engineering production controversy has been sustained mainly by politicians, not all of whom have shown any real comprehension of what is involved. A little knowledge is a misleading thing, and forensic engineering produces no forgings. During the boiler controversy the Government spokesmen frequently quoted practice in other navies, and on one occasion Italian practice was referred to. This brought from the late Sir William Allan—then Member for Gateshead and a marine engineer—the refreshing retort: "What can a nation of organ-grinders know about boilers!"

In these latter days critics of the Government are too prone to depreciate rather than criticise British engineering management, forgetting that its products have played a vital part in preserving the nation through the dangers of the past two years. Continental engineering management has received enormous assistance from the State, but under the impact of total war the very vastness of its monuments has proved a source of vulnerability, just as the jumbo-mania of their colossal goods yards and inland docks have offered tremendous targets to Bomber Command. If Dr. von X and his like had planned our industrial organisation with the arbitrary assistance of Reich Marshal Göring and his production planners, no doubt we should have had spread over Britain those gargantuan blast-furnace-to-packing-shed plants which have provided real cake for the R.A.F. at Düsseldorf, Essen, and elsewhere. It is good, from the point of view of specific industrial efficiency, that large units should be employed, but in total war the bigger the unit—whether a steel works, chemical factory, power station, or shipyard—the greater the hazard. Essen, Düsseldorf, Ludwigshafen, Leuna, Duisburg, Bielefeld, Gelsenkirchen, Hamm, and the like present industrial objectives which are the bomb-aimer's dream of a perfect target, since the very anatomy of manufacturing efficiency as practised in Germany exposes vast aggregates to complete confusion if a hard crack comes down on a vital organ. There are steel works in the Ruhr whose boast has been that the only place where raw coal is used is in the coke ovens. This is a fine thing in the tranquil times of peace, but an odd 500 kilos. of highly nitrated retaliation may have the perilous effect of throwing the whole thing completely out of gear.

Wide subdivision of manufacturing industry has, let it be confessed, its drawbacks, but there are industrial towns in Britain where production is spread over thousands of establishments. Bombs may puncture them here and there, but there is no laceration of a jugular vein. We have to be thankful not only for the great segregation of metallurgical and manufacturing industry, but for the existence, at a plurality of sites, of great diversity of product. Had the industrial units of Great Britain been concentrated on the colossal plan imposed in Germany, the present critics of our industrial production would be in full cry for the blood of those who had thus rendered us naked to our enemies.

Discussions in the United States—the home of the most gigantic metallurgical and engineering units in the world—have indicated the great importance for defence production of existing segregated machine tool equipment. An eminent manufacturer who contributed a paper before the recent National Defence Meeting of the American Society of Mechanical Engineers stressed the importance of carrying on defence production work on existing machines. "This brings us back," he said, "to old equipment now standing on the floors of the factories of this country. It is my firm belief that there is more of this equipment—old, but still productive—in existence in the United States than has yet been revealed by any survey hitherto undertaken. . . . To-day, wars are not won at the front. They are won in factories. . . . The success of this country [the United States] in its national defence effort rests upon our capacity to speed up production. The author claims that production can best be speeded up to-day by putting into operation every possible existing machine, whether it be five or even thirty years old." These are wise words, and if they can be applied to engineering production in the United States (where the machine tool industry will during this year produce at least 750 million dollars worth of machine tools), they are still more applicable to manufacture in Great Britain. Some time ago the British farming industry was a common butt for destructive criticism. Then came a visit from the leading American exponent of large-scale farming. After making a close survey this specialist broadcast a message in which he paid a most handsome tribute to the British farmer, and confessed that there was little which could be suggested in the way of modification in methods.

It is not long since strenuous propaganda was being carried on for the employment of oil engines for operating fast passenger traffic on our main line railways. The Germans, it is true, swallowed their own medicine, a medicine concocted not without much guile. Millions of marks were spent by them and by all whom they could influence—particularly the Dutch—on railway oil engine equipment. To-day this capital is standing idle, and had the investment been made in steam locomotives and normal steam-hauled vehicles, the transportation

NATCHEZ-VIDALIA BRIDGE OVER MISSISSIPPI RIVER

position in Germany and elsewhere would have been less of a problem than, happily, it now is. On the other hand, the British railways are handling more passenger traffic than ever before, and handling it with home-produced fuel.

It is not maintained that things in Great Britain are perfect. Far from it. We have every need to stretch ourselves to the very utmost and bring all equipment, new and old, special and conventional, into the total scheme of organised activity. But great resilience has been shown, and if aviation engines are being manufactured in factories laid out originally for making shoe machinery, and if garages, timber yards, railway arch workshops, and the like are contributing in trickles to a great stream of essential supplies, so much the better for the sum of production effort, and so much less the hazard of catastrophic functional interruption.

There is altogether too much loose talking about the "chaos" of production and transportation in Great Britain, and too little recognition not only of what might be called the national sagacity, but of the mighty effort made by managements and labour alike. True, friends of progress and honest believers in the value of criticism are sickened by the spouting of people who know nothing of the job, and are sceptical of the capacity of their own countrymen, whether engineers or farmers. "Sceptical innovators," said Dr. Johnson, "are vain men, and will gratify themselves at any expense. Truth will not afford sufficient food to their vanity; so they have betaken themselves to error. Truth, Sir, is a cow which will yield such people no more milk, and so they are gone to milk the bull."

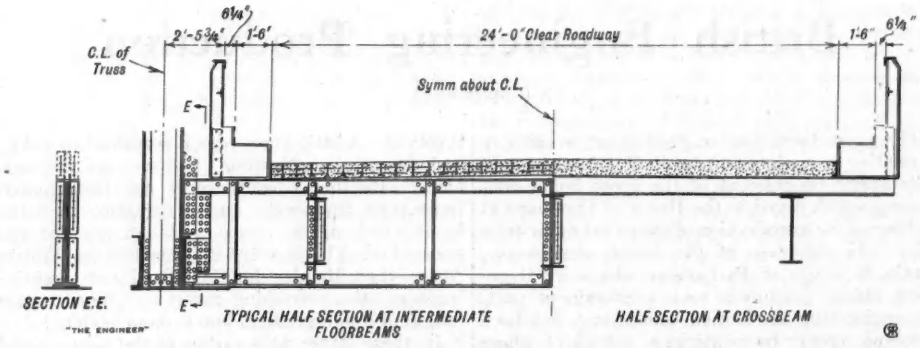
SHORTAGE OF NEW ROAD VEHICLES.—The Director-General of the Ministry of War Transport announces that, to make good a shortage of home-produced new road vehicles, a number of International Harvester chassis have been purchased from the United States of America and are now being assembled in this country. Any operator of road transport who is urgently in need of trucks or lorries and whose application for a licence to acquire a new vehicle has not yet been dealt with should write to the Road Transport Division (Room 516), Horseferry House, Horseferry Road, London, S.W.1, if he wishes to obtain a licence for one of these vehicles. The price is £710 for the chassis and cab and the completed vehicle, which is right-hand drive, will carry up to 7 tons. Arrangements have been made for a satisfactory supply of spares, and early delivery of the vehicles may be obtained.

The Natchez-Vidalia Bridge on the Mississippi River

No. I

THE Natchez-Vidalia bridge, the latest fixed crossing erected athwart the sweep of the lower Mississippi River, was placed in service last September. The bridge meets a demand that had become increasingly pressing and particularly so latterly because of the steadily mounting volume of motor traffic moving east and west through Natchez and Vidalia on long-distance hauls. It is on a Transcontinental highway that reaches from the coast of California to the Atlantic seaboard of the Carolinas. Diesel-driven ferries were running on a fairly frequent schedule when the Natchez-Vidalia bridge was opened. Since then they have been withdrawn. The bridge was built exclusively for highway traffic, and its construction was made possible by an outright grant by one Government agency and by a loan from another Federal organisation. The entire cost of the undertaking has totalled about 3,735,000 dollars. Tolls are counted upon ultimately to wipe out bonded indebtedness amounting to 55 per cent. of the cost, the remainder being met by a Public Works Administration grant.

The total length of the main crossing between the abutments on the two sides of the river is 4205·25ft., and extending inshore from each abutment there is an approach structure that has a length of about 1950ft. These approaches differ radically because of the nature of the topography adjacent to the bridge on the Mississippi and Louisiana sides of the waterway. The ground is so low at Vidalia that the town would be 15ft. under water at the highest stage of the river but for a protecting levee, while Natchez surmounts a bluff ridge that is at an elevation of more than 200ft. above the river. The War Department, which controls all of the nation's navigable waters, required that the under clearance of the bridge, where it crosses the main channel way, should be at least 65ft. when the river is at its highest flood stage. The difference between the mean low-water stage and high water during flood periods



CROSS SECTION OF BRIDGE

may be as much as 54·09ft. A flood stage always increases the velocity of the stream flow and to a marked extent. Three of the piers are in the sweep of the river at flood stages, and that situation necessitated rapid work and special measures during the construction of those particular piers.

The main structure is made up of five spans that are of the cantilever through-truss type. The anchor span at each end of this structure has a length of 560ft., and, taking the spans, from east to west, spans 2 and 3, which extend above the channel way, are each 875ft. in length, while span 4 which is normally entirely overland, has a length of 797·50ft. The cantilever structure has therefore a total length of 3667ft. Between pier 5, which supports the landward end of the west anchor span and the west abutment, in Vidalia, the bridge consists of six spans of the deck girder type, and this section of the structure has a length of 538ft. and carries the roadway on a descending gradient to a fill that swings into a connecting thoroughfare in Vidalia.

Between the eastern abutment and the business centre of Natchez the approach roadway traces a wide arc and rises from the bridge to the toll plaza on a climb of 70ft. with a maximum gradient of 5·63 per cent. For most of the distance the roadway crosses two valleys that flank an interposed hill. In the deeper of the valleys the fill or embankment has a depth of 92ft. and the open cut excavated through the crest of the hill has a maximum depth of 60ft. The approach roadway has a width of 45ft. and is finished with a concrete pavement.

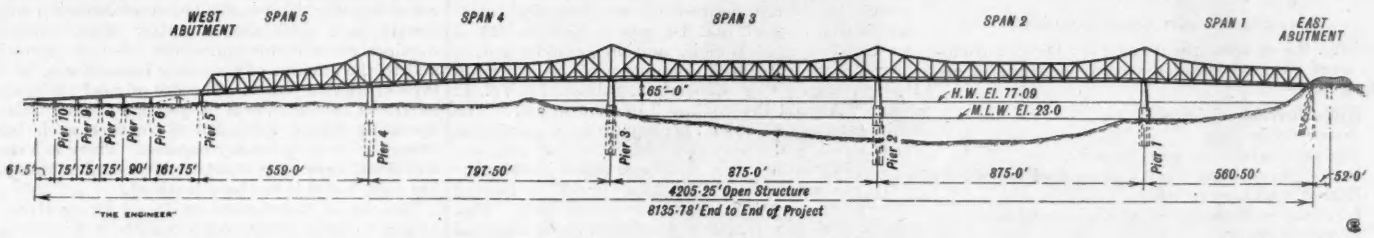
When the planning of the bridge was well advanced and provision made for a suitable landing in Vidalia as then existed, the Corps of Engineers of the U.S. Army decided to broaden the floodway of the river by removing the existing west bank levee and building a new levee 1200ft. inshore. This rearrangement of the protecting barrier for low-lying Vidalia entailed the demolition of a considerable section of the town and the wholesale shifting of many of the established buildings. The enforced readjustment of thoroughfares and highway connections compelled consequent changes in the Vidalia approach to the bridge. While this occasioned no engineering difficulties, it did, however, cause delays, and in the end interfered with the original construction programme, absorbing the time of certain months most favourable to rapid work. When construction did begin every effort was directed to speeding all operations wherever practicable. It was because of this urge, which was active from start to finish of the job, that the bridge was built within a record interval of but twenty-one months from the letting of the first construction contract to the day of completion.

To expedite the work under the rapid programme decided upon Messrs. Ash-Howard-Needles and Tammen, the engineering firm who designed and supervised the building of the bridge, divided construction operations into ten main contracts. In turn, several of the main contractors employed various sub-contractors who were recognised specialists in particular operations, and by this arrangement a total of eighteen different contracting organisations were engaged on the job. The larger of the ten main contracts and the contractors concerned were :—

Four river piers... ...	Dravo Corporation
All other substructure	R. J. Reid Contracting Company
Earthwork	Edward E. Morgan Company, Inc.
Superstructure, manufacture and erection	Bethlehem Steel Company
Electrical work, office building, &c.	Forcum-James Construction Company
Concrete pavements, &c.	St. Catherine's Gravel Company

Before describing the methods employed in getting the sub-structure of the piers down to firm ground it seems desirable to give some particulars about the steel superstructure of the river crossing. Much of the information following has been supplied by Dr. Howard, a member of the firm of consulting engineers. The trusses of the cantilever sections of the bridge are 33ft. apart, centre to centre, and between the trusses the floor system carries a reinforced concrete roadway, 24ft. wide, between the flanking lower kerbs. On each side of this roadway and above it there is an 18in. walkway, which, on its outer side, is flanked by an upper kerb—increasing thereby the protection offered to skidding vehicles. The walkways are intended only for emergency use by motor travellers and for the safety and convenience of guards and other persons engaged in operating or maintaining the structure. The reinforced deck has a thickness of 7¼in. and a crown of 1½in. The reinforcement of the deck consists of shop-fabricated trusses in sections that permitted easy handling in the field. The vertical clearance between the surface of the roadway at centre line and the underside of cross bracing members of the superstructure is 16ft. The crown of the bridge deck is at the channel crossing at El. 148 above the datum of mean Gulf level. The main posts of the span trusses are 110ft. high, and the posts rest on steel shoes secured to the tops of the four main piers. The height of the trusses in the centres of the main spans is 55ft. There is a strong guard rail along each side of the bridge, and details of the floor system are shown by an accompanying drawing. The weight of steel in the finished superstructure and its appurtenances is about 16,500,000 lb.

(To be continued)



DIAGRAMMATIC ELEVATION OF NATCHEZ-VIDALIA BRIDGE

Steam *versus* Diesel-Electric Locomotives*

By E. E. CHAPMAN†

ABOUT three decades ago when the electric locomotive, which secures its power from outside sources, was developed, designers prophesied that within the next decade the railways of the United States would purchase only electric locomotives for new power. While this prophecy has not been fulfilled, certain railways in this country have electrified their motive power on selected parts of their roads. There are about 900 such electric locomotives in service at the present time. The heavy expenditures required for stationary power plants and power lines have limited such applications generally to heavy traffic lines or to locations where electric power was available from hydro-electric plants or where power plants could be located at mine head to avoid expense of handling fuel.

Previous to this period an internal combustion engine was invented by Rudolph Diesel, which utilised the heat of compression for igniting the fuel. This engine showed a high thermal efficiency, and such engines were installed widely in stationary and in marine service. However, the weights of these engines were so excessive there was no extensive use of them in the railway propulsion field before 1925. From 1925 to 1935 a steadily increasing number of such engines with electrical transmission was placed in switch service. In 1935 a two-cycle Diesel engine of considerably less weight per horsepower was developed by the Winton Company, which was later taken over by the Electro-Motive Corporation. Since then both two-cycle and four-cycle Diesel engines have been used extensively in switch locomotives. Most of the applications to passenger and freight locomotives to date have been two-cycle engines, but some four-cycle Diesel engines are now in passenger service.

Since 1925 a total of about 1300 switch, passenger, and freight Diesel-electric locomotives have been placed in service, of which approximately 35 per cent. went into operation in 1940.

In this comparison of various prime movers on American railways it is well to show the trend of purchases of the three principal types of locomotives for the last five years, as given in Table I :—

TABLE I.—*Locomotives on Domestic Order*, 1936–40
(*Railway Age*, January 4th, 1941)

Year.	Steam.	Diesel-electric.	Electric.
1936	435	77	24
1937	173	145	36
1938	36	160	29
1939	95	246	32
1940	219	462	13
Total	958	1090	134

For the year 1940 about 80 per cent. of Diesel locomotives purchased were switchers and transfer locomotives, while 20 per cent. were freight and passenger. On a horsepower basis, about 60 per cent. were switchers and transfer, and 40 per cent. freight and passenger Diesel locomotives.

For the year 1940 only six steam locomotives, or less than 3 per cent. of whole, were purchased for switching service. The remainder were purchased for passenger and freight service. A careful analysis of switching operation indicates that where locomotives can be utilised for two eight-hour tricks per day or more, Diesel switch locomotives of 600 H.P. capacity (and above) are justified. Where Diesel switch locomotives with 44 tons of weight on driving wheels can be used, they can be justified for one-trick-per-day service.

COMPARISON OF DIESEL-ELECTRIC AND STEAM LOCOMOTIVES

For comparative purposes the general dimensions and power performance characteristics of certain Diesel locomotives and comparable conventional steam locomotives are listed in Table II. Power performance data, *i.e.*, draw-bar horsepower on level tangent track, are shown graphically.

TABLE II.—*Principal Dimensions and Characteristics—Diesel* versus *Steam Locomotives*

	Diesel locomotive.		Steam locomotive.		
	4,000 H.P.	5,400 H.P.	4–6–4.	4–8–4.	2–10–4.
Length overall	141ft. 7½in.	193ft.	102ft. 6⅝in.	112ft. 1½in.	113ft. 6⅞in.
Total wheelbase	117ft. 1in.	177ft.	88ft. 8in.	98ft. 2½in.	100ft. 3½in.
Rigid wheelbase	14ft. 1in.	9ft.	14ft. 6in.	13ft. 10in.	19ft. 3in.
Weight, total, lb.	626,200	923,600	808,626	895,846	934,766
Weight on drivers, lb.	426,800	923,600	213,440	286,890	371,990
Wheels, number and diameter—					
Engine truck	8, 36in.	—	4, 37in.	4, 37in.	4, 37in.
Drivers	16, 36in.	32, 40in.	6, 84in.	8, 80in.	10, 74in.
Trailer truck	—	—	4, 40in.	4, 40in.	4, 40in.
Tender	—	—	12, 37in.	12, 37in.	12, 37in.
Fuel oil capacity, gallons	2,400	4,800	7,000	7,000	7,000
Boiler water capacity, gallons	2,900	—	21,000	21,000	21,000
Cooling water capacity, gallons	600	900	—	—	—
Lubricating oil capacity, gallons	520	700	—	—	—
Starting tractive effort, lb.	106,700	220,000	49,300	66,000	93,000
Factor of adhesion	4·00	4·20	4·33	4·35	4·00
Draw-bar horsepower at 10 m.p.h.	2,270	3,870	1,210	1,670	2,430
20 ,,	2,930	4,850	2,240	3,170	4,340
30 ,,	2,910	5,040	2,990	4,230	5,100
40 ,,	2,840	5,070	3,450	4,530	5,310
50 ,,	2,810	4,930	3,600	4,550	5,280
60 ,,	2,760	4,720	3,550	4,450	5,120
70 ,,	2,680	4,400	3,270	4,160	—
80 ,,	2,510	—	2,790	3,720	—
90 ,,	2,260	—	2,160	3,120	—
100 ,,	1,750	—	1,400	—	—
110 ,,	950	—	—	—	—

Table II. shows a two-cycle Diesel engine of 4,000 H.P. and a four-cycle Diesel engine of 5,400 H.P. The 4000 H.P. Diesel and the 4–6–4 type steam locomotive are essentially similar. However, it can be seen that at speeds below 29 m.p.h. and above 87 m.p.h., the 4000 H.P. Diesel locomotive has more horsepower available at the draw-bar than the 4–6–4 type steam locomotive. The lesser weight of the 4000 H.P. Diesel locomotive is a distinct advantage also.

The 5400 H.P. Diesel locomotive is superior to the

* American Society of Mechanical Engineers, June, 1941.
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4–8–4 type steam locomotive throughout its speed range. However, the 4–8–4 type steam locomotive is designed for a maximum speed of 90 m.p.h., while the 5400 H.P. Diesel locomotive is designed for freight service primarily with speed limited by motor restrictions and gear ratio to a maximum speed of 77 m.p.h. The 2–10–4 type steam locomotive develops more horsepower at the draw-bar than the 5400 H.P. Diesel locomotive at speeds above 29 m.p.h. However, the marked superiority in draw-bar horsepower of the Diesel locomotive at speeds under 29 m.p.h. gives it a distinct advantage, not only in starting and accelerating heavy trains, but also in maintaining higher speeds on ruling gradients.

It should be noted, however, that motor limitations restrict the loading of the Diesel freight locomotive on any gradient to what it will handle at a minimum speed of 16 m.p.h., and for Diesel passenger locomotive what it will handle at 35 m.p.h., at which respective speeds motors can be operated at continuous rated output.

Advantages and Disadvantages

Briefly, the advantages claimed for Diesel locomotives over the conventional steam locomotives are as follows:—

High thermal efficiency.
Lower water costs.
High utilisation—greater flexibility.
Reduction of delay due to taking fuel and water.
Higher sustained speeds.
Lower stresses imparted to track structure.
Dynamic braking.

The disadvantages are as follows:—

High initial investment.
Lower life expectancy.
Demand for higher degree of maintenance.
Higher unit cost of fuel.
Higher cost of lubrication.

Thermal Efficiency.—A comparison of overall thermal efficiency—ratio of power output at draw-bar to heat content in fuel—shows the Diesel locomotive to have an average thermal efficiency of 26 to 28 per cent., while comparable modern steam locomotives have a corresponding thermal efficiency of 6 to 8 per cent. Because of this, there is a two-fold advantage for the Diesel locomotive in that there is a reduction in the amount of fuel necessary to carry and an increase in the length of operation between refuelling.

Lower Water Costs.—On steam locomotives lower water cost is an item of some importance. The average water cost for a steam locomotive is approximately 10 per cent. of the fuel cost. On Diesel locomotives, water is a relatively small item, even on passenger Diesels where steam generators are used to furnish steam for heating or for air-conditioning passenger trains. The amount of water required for this purpose is only about one-tenth of the total water used for all purposes by a steam locomotive in the same service, so that for passenger Diesel locomotives water costs will be not over one-tenth that for steam locomotives. For freight Diesel locomotives water costs are practically negligible.

Utilisation and Flexibility.—Utilisation may be measured in two ways. For passenger and freight locomotives, the mileage per locomotive per year indicates directly the relative utilisation. For passenger Diesel locomotives, the average mileage per year is 250,000, with a maximum monthly mileage of 27,000, as compared with 180,000 miles per year and a high monthly mileage of 18,000 to 19,000 for modern steam passenger locomotives. At the present time Diesel passenger locomotives are largely assigned to definite runs, for which their availability has proved to be 95 to 99 per cent. In switch service, utilisation is usually measured by hours of service performed out of total monthly hours. In this service generally Diesel switch locomotives have a very high utilisation factor.

The Diesel locomotive has a greater flexibility in that the locomotive may be accommodated to the train to be handled. On long runs over varying gradients, one or more engines may be cut out entirely on lighter gradients, where not necessary, and cut in for work in mountainous territory. This flexibility also permits of some inspection and light maintenance of engines while *en route* to keep them in first-class condition at all times. Where locomotives are in multiple units, it is possible to use the minimum number of units required on level territory and add necessary units for work on heavy ascending gradients.

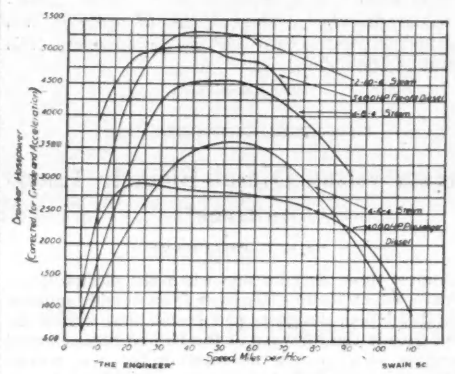
Reduction in Delays.—The reduction in delay time due to taking fuel and water is a distinct advantage for the Diesel locomotive. The ability of the Diesel locomotive to run long distances between fuel and water stations, as compared with steam locomotives, is an important consideration in long transcontinental passenger runs, and also in the operation of expedited schedule freight trains. Delays between major terminals for fuel and water have been eliminated, and the terminals at which fuel and water are taken are so located that the delays for this service are at least partially absorbed in that some time is necessary at these terminals for other services.

Higher Sustained Speed.—The reduction in delay time in stopping and starting for taking fuel and water permits of higher sustained speed, without the necessity for running at high maximum speeds. In addition, the high available draw-bar horsepower in the lower speed range gives the Diesel locomotive an advantage in that considerably less time is consumed in accelerating to the speed required to make schedule time. Faster schedules are thus maintained at a more nearly uniform average speed and a lower maximum speed. The rapid acceleration of the Diesel locomotive at low speeds is a distinct advantage in freight service in that less time is required to accelerate to speeds of 16 m.p.h. or above, where the continuous rating of the locomotive is utilised.

Lower Stresses in Track Structure.—The stresses imparted to track by prime movers is an increasing concern to the management of railways. Diesel locomotives, which have no unbalanced weights in their wheels, remove the danger of kinking rails. However, with such locomotives able to travel at speeds up to 120 m.p.h. in passenger service, it is well to be sure that wheel diameters and wheel loads be so proportioned that shearing stresses in the head of the rail, and particularly in the potential shatter crack zone, be kept within prescribed limits.

Such limits are derived by mathematical computation of Hoersch and Thomas in Bulletin 212 of the University of Illinois, and in computation of shear stress by the Rail Committee of the American Railway Engineering Association, published in Vol. 42 of the "Annual Proceedings" of that society. The limits used are 67,000 lb. per square inch maximum shear stress ½in. below the surface of the rail, and by keeping to this limit the shear stress in the zone of the rail where shatter cracks occur will be limited to a maximum of 25,000 lb. per square inch. Test results have shown that a maximum shear stress of 25,000 lb. per square inch in the potential shatter-crack zone will protect against propagation of transverse fissures from shatter cracks.

Dynamic Braking.—The development of the freight Diesel locomotive has reintroduced a method of braking, or rather of controlling speed of freight trains on long descending gradients. Dynamic braking is essentially utilisation of the power in the



(Available draw-bar horsepower on level tangent track, 4000 and 5400 H.P. Diesel locomotives and 4–6–4, 4–8–4, and 2–10–4 steam locomotives.)

Power Performance of Diesel and Steam Locomotives

locomotive to hold the train by reversing the direction of the field current, by means of which motors are converted into generators and the current generated is dissipated, through resistance grids mounted in the roof, in the form of heat, which is absorbed by an air cooling system. This is similar to the regenerative braking on electric locomotives, in which the current generated is fed back to the power source. The dynamic brakes are designed to hold at a definite speed on a descending gradient the same train weight that the locomotive could haul up the same gradient at the same speed. In actual operation, on descending gradients, train weight is usually heavier and speeds maintained are higher than on the same gradient ascending, so that for controlling such trains some assistance for the dynamic brake is required from the train air brakes. In trials of this brake on various grades, the amount of train air braking required was reduced to approximately one-fourth of that required by conventional braking with train air brakes. The possibility for reduced maintenance owing to less wheel and brake shoe wear is of sufficient importance to encourage further development of this brake for locomotives in mountain service. There is also a direct challenge to the steam locomotive designers for some similar method of braking. A possible method would be in utilisation of cylinder compression, the heat of compression being dissipated by evaporating water into steam.

High Initial Investment.—In any discussion of disadvantages of the Diesel locomotive, the question of cost of initial investment is an important consideration in comparing Diesel against steam locomotives. Recent improvements in production methods and increasing numbers in production have gradually lowered the cost per horsepower of Diesel locomotives to approximately 87·50 dollars, while for steam locomotives of comparable horsepower costs are approximately 35 dollars per horsepower. The higher initial cost is partly offset by the greater utilisation of the Diesel locomotive, which helps to keep down the overhead cost per mile of operation.

Lower Life Expectancy.—With no background other than experience in the automotive industry, the life expectancy of the Diesel engine has been estimated at a relatively lower figure than for steam locomotives. Depreciation rates are based on an assumed expectation of fifteen years of service for road Diesel locomotives and twenty years for switch Diesel locomotives, against an accepted figure of approximately twenty-eight years for steam locomotives. Experience gained from continued use of Diesel locomotives in all kinds of service may justify an upward revision of the life expectancy at some future time. Meanwhile the low assumed figure is a definite handicap, because of the resulting increased fixed charge.

Demand for Higher Degree of Maintenance.—The close tolerances on numerous parts, together with the complications owing to interlocking of electrical and mechanical equipment, call for a higher degree of maintenance of the Diesel locomotive. On the other hand, refinements in steam locomotives, such as roller bearings, improved counterbalancing for higher speeds, and additional auxiliary equipment that requires close maintenance for efficient operation, add to the amount of necessary maintenance on this type of motive power. The use of road maintainers on Diesel locomotives is in question; some railways operating Diesel locomotives consider such maintainers as an unnecessary expense. There is a direct additional operating charge where road maintainers are used, but this has been justified.

The use of maintainers on Diesel locomotives has helped to keep maintenance costs to a minimum, in that prompt attention when necessary has forestalled costly breakdowns on the road and has provided an intimate knowledge of work requiring immediate attention at terminals. The actual comparative maintenance costs of the two types of motive power are nearly equal, considering that no cost records are available for general shopping of Diesel locomotives, and there is a question of necessity of general shoppings for Diesel locomotives.

The lack of specially trained men and necessary equipment has been a handicap for keeping down cost of maintenance on the Diesel locomotive, but this handicap is being eliminated rapidly.

Higher Unit Cost of Fuel.—As already noted, the thermal efficiency of the Diesel locomotive is approximately three to four times that of the modern steam locomotive. The lower fuel consumption is somewhat offset by a higher unit cost of fuel, but in spite of the higher unit cost, the net cost of fuel consumed per unit of power developed is approximately one-half to two-thirds that of unit fuel cost of comparable steam locomotives. In localities where unlimited quantities of good quality steam locomotive coal are available at low cost and with little transportation requirements, the foregoing comparison might not hold good. Similarly, those railways that are close to oilfields and refineries that can offer large quantities of residuum fuel oil at low cost cannot always justify use of the higher-priced Diesel fuel oil. Conversely, in some localities where there is a scarcity of fuel, the saving in transportation charges because of the much smaller quantity required will justify the use of the Diesel locomotive because of fuel saving.

The operation of Diesel locomotives requires that fuel oil specifications be held within a close range, which accounts in part for the higher unit cost of fuel. In the adoption of Diesel motive power exclusively, it must be remembered that other fuels are eliminated from competition. This is not the case with the steam locomotive, since with this prime mover the competitive condition existing between coal and fuel oil tends to keep unit costs at a reasonably low level. Any abrupt change in the price of either fuel immediately justifies a change by adapting the steam locomotive to burn the lower-priced fuel.

Higher Cost of Lubrication.—The overall cost of lubrication is definitely in favour of the steam locomotive. The quantity of lubricating oil required, as well as higher price, makes the net cost approximately double for the Diesel locomotive as compared with the steam locomotive. With either type of power, the lubricating cost is a relatively small percentage of the total cost of operation.

Accomplishments of Diesel Locomotives

A *résumé* of what has been accomplished by Diesel locomotive operation in main line service is as follows:

(1) The schedule time for passenger service between important terminals has been reduced. There has been a steadily increasing number of higher-speed passenger trains placed in service by various railways, all of which have proved to be popular with the travelling public. Incidentally, some railways which inaugurated higher-speed service utilising steam motive power initially have since changed to Diesel power for this fast service.

(2) In freight service, it has been possible to increase both the tonnage hauled and the average speed between terminals. The power performance, particularly in the lower speed range, has made it possible to operate trains over most ruling gradients without need for helpers or for double heading.

(3) In bad weather with adverse rail conditions, the Diesel locomotive because of uniform torque on driving wheels and distribution of available tractive effort over a greater number of driving wheels has

demonstrated its ability to maintain schedules without reduction in weight of train handled.

(4) The Diesel locomotive has shown the possibility of long locomotive runs, with very little service required for locomotive at intermediate division points. It has directed attention to the fact that the only economical operation is obtained from motive power that is moving. Indirectly, attention has been focused on terminal delays to freight trains and also to the need for improvement in getting trains through divisional terminals.

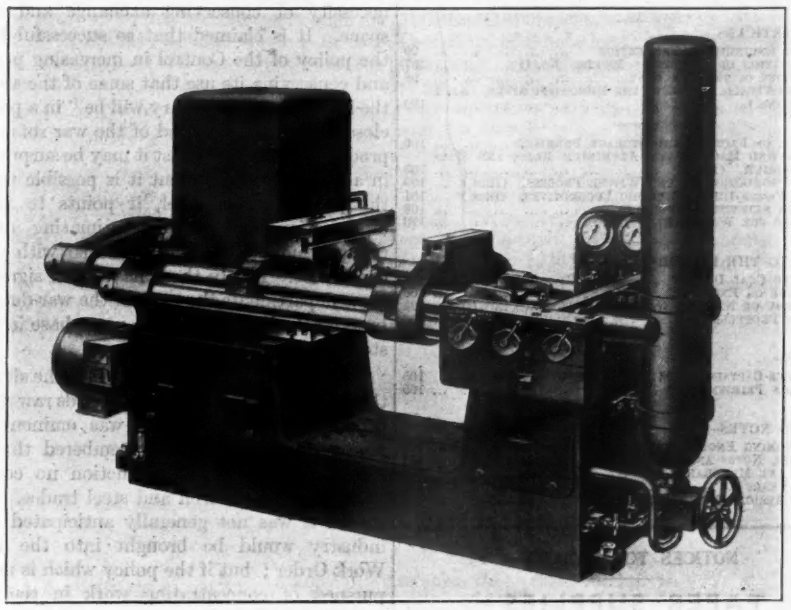
(5) It has stimulated the energies of the steam locomotive designers to develop steam motive power that has performance characteristics to compete with those of the Diesel locomotive. At the present time there is a need for an all-purpose Diesel locomotive that can be utilised in either freight or passenger service, and which will fit with steam locomotive helpers where such helper service is required.

In conclusion, it would be far-fetched to intimate that the Diesel locomotives will displace steam locomotives altogether in railway service, but they are definitely a part of the picture. As more and more of them are built, there undoubtedly should be a decrease in the unit cost. This will narrow the gap now existing in the relative initial investment of the Diesel *versus* the steam locomotive. At the same time, it is to be expected that competing steam locomotives will have considerably improved performance characteristics to match those of the Diesel locomotive.

Die Casting Machine for Aluminium, Brass and Magnesium

We illustrate herewith the "Edgwick" cold chamber die casting machine, which has recently been produced by Alfred Herbert, Ltd., of Coventry, for the production of die castings by the cold chamber method. In cold chamber machines the melting furnace for the metal is separate from the machine. A ladleful of molten metal is poured into a bushing, which is usually water cooled, and is transferred by means of a plunger into the die cavity. At first glance this method may seem to be somewhat clumsy, as compared with the gooseneck type of machine, in which the metal is melted in the machine itself and delivered through a cast iron gooseneck under pressure into the die cavities, either by means of a submerged plunger pump or by means of compressed air admitted to a sealed chamber above the molten metal. The reason for the use of the cold chamber machine with its separate furnace is that certain metals, such as aluminium, absorb the cast iron from the pot and gooseneck when heated in contact with these parts. High-silicon aluminium alloy, which is very suitable for pressure die castings, has a strong affinity for cast iron. Therefore in the cold chamber machine the melting pot is made of plumbago and the molten metal is only in contact with the steel bushing of the machine for about one second, as it is transferred to the die cavities immediately it is poured into the bushing and is cooled rapidly in the die. The same method is used in casting brass and magnesium, although magnesium is more difficult to deal with, owing to its tendency to fire when in contact with the air. It has been found, we are informed, that "Nitralloy" hardened steel gives the best results for the cold chamber bushing and plungers, owing to the heat-resisting qualities of the surface.

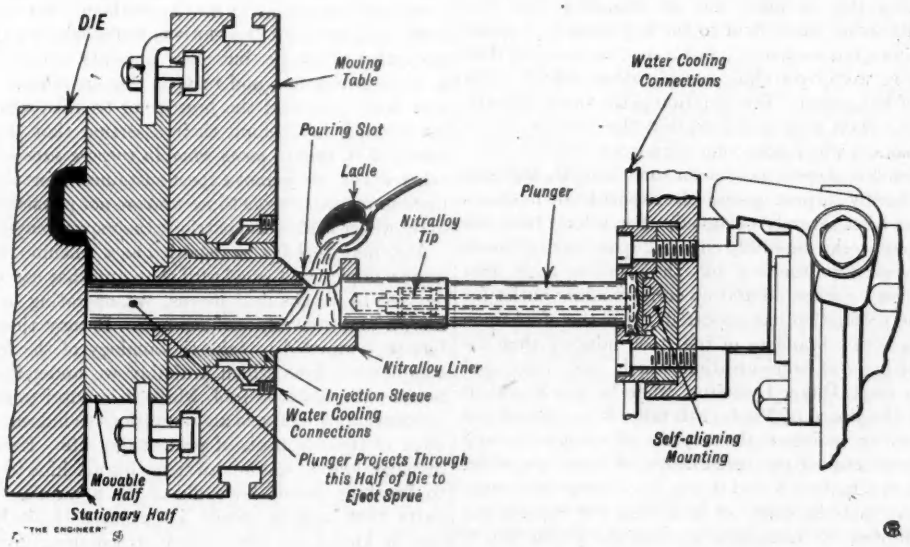
The Edgwick cold chamber machine is entirely self-contained, the main drive being by means of a 7½ H.P. motor driving a Vickers high-pressure oil pump. The base of the machine forms an oil tank, and is fitted with weirs and oil filters, so that the oil is cleared of air bubbles and dirt before it is pumped into the machine. The tank is fitted with easily removable covers for cleaning. The dies are closed by means of a hydraulic cylinder mounted at the headstock end of the machine. In combination with a prefiller valve and intensifier, a locking pressure of 50 tons is developed when the dies are closed. On the actual closing and opening stroke less pressure is required from the pump, and consequently economies are effected by a reduction in power during this period. The hydraulically operated prefiller valve admits oil from the gravity tank above the headstock, and is arranged to close when the dies come together. An oil flow restriction device is included in the oil feed circuit to the main cylinder, and is so arranged that the movement of the dies is slowed down just before they close. For this reason it is essential that the total thickness of the die halves should be kept at 10in. Where necessary this dimension can be made up by means of bolster plates fitted to the dies.



COLD CHAMBER DIE CASTING MACHINE

The die plates are fitted with tee slots for attaching the die members. The moving die plate is equipped with the cold chamber pouring bushing, the front of which acts as a pilot for locating the die. The injection plunger which operates in this bushing also projects through the moving die in the open position to eject the slug of metal left in the bushing after the casting is made. When the dies open, the injection plunger remains forward so that the slug is forced out of the die plate by means of its movement relative to the plunger. After the slug has been ejected, the further movement of the die plate returns the injection plunger, together with its cross head and operating plunger to the initial back loading position. At this point two steel catches engage with two hardened pads on the crosshead, so that it is retained in its back position during the next closing stroke of the dies. The pouring bushing is arranged with a water cooling duct between its outside diameter and the die plate itself. This is necessary to prevent the temperature of the pouring bushing getting too high, and also to cool the slug rapidly. The injection plunger which works within the cold chamber bushing is also water cooled, and a spherically mounted self-aligning coupling is fitted at one end to prevent any slight misalignment of the plunger and the bushing which would cause excessive wear and scoring of these parts.

When the moving die plate is closed for the next shot, the injection plunger is held back, as previously described, and the bushing is pulled off the plunger, thus exposing the pouring slot in the top. This provides a safety device to prevent metal from being ladled into the bushing before the dies are closed, as, with the dies open, the plunger is within the bushing and covering the pouring hole. The operation of the injector plunger is accelerated by means of a nitrogen-charged accumulator bottle, so arranged that it is initially charged with nitrogen gas from a commercial bottle of compressed nitrogen. The hydraulic pump on the machine then forces oil into the bottle at a higher pressure, so that the compressed nitrogen gas acts as a spring in the oil circuit, the effect being to give a rapid stroke to the injection plunger. The oil taken from the bottle during the injection stroke is returned by the pump during the cooling time of the casting. With the machine in continuous use there is no loss of nitrogen, but loss may occur if the machine is shut down for a considerable period, should the valves leak to any extent. A by-pass valve, in conjunction with a pressure-reducing valve, enables a choice of two pressures to be made for charging the nitrogen bottle. The reason for this provision is that the capacity of the machine can be considerably increased when it is used with zinc, which needs a lower injection pressure on the metal if the initial oil pressure in the bottle is reduced. The reducing valve on the Edgwick machine is set to charge the bottle at a 50 per cent. reduction in pressure, so that castings of twice the area can be dealt with.



ARRANGEMENT OF PLUNGER AND DIE

A feature claimed to be novel is the use of a separate hydraulically operated plunger built into the middle of the fixed die plate and arranged for coupling to the ejector mechanism in the die for the ejection of the finished casting. The movement of this plunger is controlled by a separate hand-operated valve on the right-hand side of the panel. In addition to the hydraulic ejector, the machine is equipped with adjustable striker clamps on the moving tie bars, which, for out-of-balance castings, can be used to move forward the ejector plate.

The method of controlling the machine is by means of three hand-operated pilot valves. The valve on the left-hand side of the panel regulates the opening and closing of the dies. Next to it is the valve for controlling the action of the injection plunger. The third valve controls the movement of the hydraulic ejector cylinder. At the back of the control panel two pressure gauges are mounted, one showing the main pump pressure, which is the locking pressure of the machine, and the other the nitrogen bottle pressure, which is the injection pressure of the machine. The standard plunger supplied with the machine for use on aluminium is $1\frac{9}{16}$in. diameter, and will inject approximately 1½ lb. of aluminium. Larger or smaller plungers and bushings can be supplied when required, which will give correspondingly higher or lower pressures, coupled with decreased or increased areas of castings.

Borrowing Locomotives.—The Canadian Minister of Transport recently announced that his Government was borrowing twenty-five locomotives from the United States until a similar number of new engines could be built in America to release them. The C.N.R. locomotive stock was adequate to haul the enhanced war traffic over the Canadian lines, but was insufficient for the lines worked by that administration in the United States.

The Engineer

AUGUST 15, 1941

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OUR STEEL INDUSTRY

THE impact of the war upon British industries has been variable in its effects, but to none has it brought about more important changes than to the iron and steel industry. The consumption of iron and steel for war purposes has been enormous, and it says much for the efficiency of the Control which was instituted at the outbreak of hostilities that supplies have been maintained under no matter what difficult conditions without interruption. So far the Control has been carried out by the promulgation of Orders, and these have satisfactorily served the purpose of the authorities. As the war goes on problems continue to arise, and it was perhaps not altogether surprising that last week it was decided to bring practically the whole of the industry within the scope of the Essential Work (General Provisions) Order, 1941. Perhaps the most heartening statement contained in the announcement of this decision was that "the country is now in the happy position of being able to meet all demands for raw steel." This may be taken to indicate that some of the major problems of the industrial war effort have been overcome and that the production of iron and steel in Great Britain plus the imports from the United States which can be reasonably anticipated should prove sufficient to meet all requirements. During time of war production figures cannot be published, but it is known that great efforts have been made to expand the outputs of the British steel works, and, according to the official announcement, "owing to the steps taken at the start of the war to control the supply of raw materials and to restrict non-essential consumption, the country is now more self-supporting in the case of steel and consequently far less dependent upon imports." This is borne out by the knowledge that the re-rolling industry and others, which of late have relied largely upon imports of American material, have been told that in future imports will be restricted owing to the necessity of conserving exchange and shipping space. It is claimed that so successful has been the policy of the Control in increasing production and conserving its use that some of the sections of the iron and steel industry will be "in a position to close down for the period of the war some of their producing units." Whilst it may be surprising that in a time like the present it is possible to restrict the production of steel, it points to successful organisation and careful estimating of future requirements to be able to do so with complete confidence. Lately there have been signs that in some departments the peak of the war demand has been reached and possibly a new phase in iron and steel production has opened.

It was generally understood that the situation in the iron and steel industry as regards raw materials, production and deliveries was eminently satisfactory, and it will be remembered that in the recent debates upon production no complaints were made of the iron and steel trades. For this reason it was not generally anticipated that the industry would be brought into the Essential Work Order; but if the policy which is now being pursued of concentrating work in the smallest possible number of producing units is carried out the problem of transferring and providing for labour must become an urgent one, and it is probable that this was one of the chief reasons why the assistance of the Order was invoked by the authorities. The branches of the industry which are likely to be the most affected will be the tinplate and sheet trades. In the former case the industry has been operating at below capacity since the Control some time ago decided that steel was more urgently needed in other directions than in the manufacture of tinplates. The result has been that a number of export orders which would have been placed in this country have been deliberately diverted to the United States. In doing this it must not be supposed that the authorities were blind to the importance of maintaining our exchange; but it may be assumed that there were overriding considerations which could not be ignored. The situation in the sheet industry for a short time has been that the volume of new business which has come forward to replace completed contracts has shown some decline, and this is hardly surprising since the export trade in sheets has been severely curtailed. For a long time the sheet works were fully engaged upon making sheets for air raid shelters, but these orders have been largely worked off and no corresponding outlet for the production has appeared. It is therefore upon these two branches of the steel industry that the methods of concentration which were envisaged by Capt. Oliver Lyttelton, when he was President of the Board of Trade, will fall. It is pointed out that to maintain the exports of tinplates would have entailed the importation of large quantities of raw materials and it was in order to save shipping that the policy of restricting our exports was adopted. By concentrating first the production of tinplates and then to a lesser degree the production of sheets it is hoped to free a considerable labour force which can be used with advantage in other branches of the industry. There must, of course, be a period in the transfer of this labour at which it will become dependent upon the Government, and to meet the whole problem of this and the supply of labour to the iron and steel industry the Government has set up a special Labour Supply Organisation designed to secure the best use of labour and to facilitate its transfer and to obtain, if necessary, additional labour from outside the industry.

Perhaps the most satisfactory revelation which has attended these drastic changes in industry is the assurance that the production of steel has so greatly increased. In certain instances we are assured that "capacity has been doubled and in some cases is as much as three to four times what it was before the war." This naturally arouses some speculation as to the future and whilst we must prepare ourselves for a long war, the responsibilities attaching to the possession of such a vastly expanded steel industry require careful consideration. It is possible that this country could be almost self-sufficient so far as steel is concerned, and it is not unreasonable to hope that in the world economic reconstruction which may follow the war means will be found for the conservation of the industry by mutual arrangements with other countries and without the employment by all nations of methods which in the opinion of many contributed in no small measure to the unrest that set the world ablaze.

Holidays

IN times of war, in which we may be said to be fighting "spiritual wickedness in high places," it may perhaps seem almost indecent to speak of or even consider such things as holidays. In peacetime it may be fittingly comfortable to endorse the theory that "all work and no play makes Jack a dull boy," but is it wise to apply such a maxim to the present day? Some will argue that "total war" requires total effort, and that accordingly holidays should be taboo for the duration of the war. But this contention only raises the issue as to what is total effort? Does it imply sustained activity without relaxation until such time as there is a complete collapse? This could only be justified if it were possible to set a definite time limit to the length of hostilities, while at the same time it could be guaranteed that sustained effort could be maintained unimpaired for that period. In the remote days of slavery and serfdom to which this country at least has no desire to return, the rulers fully realised the necessity for introducing some form of relaxation which would give their henchmen something to which they might look forward with pleasurable anticipation, and which would lend colour to their otherwise drab existence. Taking advantage of the religious outlook of those who laboured for them, holy days were instituted, days which, although partly assigned to devotional exercises, were largely made the occasion for different forms of sport. By degrees the character of these days changed, and they became almost solely times of sport and recreation —holidays, in fact, as we now know them. It is not to be imagined that the motives behind them were altogether altruistic, but these ancients were wise in their generation, and realised that monotony is soul destroying and the breeder of trouble, while much truth lay behind their assertion that it is essential to ensure *mens sana in corpore sano*—in other words, we cannot expect sustained effort and maximum output from those who are not physically fit, however willing and patriotic their spirit may be.

Man may perhaps be regarded as a machine, far more complex and wonderful than any that can be devised by mechanical means, yet operating in a known and conventional manner. It may therefore be permitted to take the analogy of the less complex machine which probably we understand better—the machine tool, which is so vital to the production of weapons and munitions as indeed, of most of the essentials of present-day life. Every manager knows that he can stress his machine tools to breaking point, he could name a number of parts that require special attention periodically, and he knows the advisability of occasional overhaul, and the rendering of maintenance services. If it were suggested to him that it would be well to run his plant without intermission until it gave out, he would probably cite to his critic the old maxim that "a stitch in time saves nine," and proceed to produce irrefutable evidence that those who operated some system that ensured the periodical overhaul of their machinery and plant obtained a better production output than that obtained by those who worked everything until summarily stopped by a breakdown. It is certainly more than exasperating to break the back of an expensive machine, and then have to admit that the accident need never have happened. If this

has been found to be true, what of the human machine? Do not the same principles operate? Assuredly they do! We can go into some factories and see the operatives and staff hale and hearty, and into others where all the employees have a weary and bedraggled look. We do not have to ask the reason; we know it. Having conceded that holidays are not a luxury, but a necessity, the question arises as to how they can be granted with a minimum of inconvenience, and the answer may glibly be given by many—by staggering them! What exactly is implied by "staggering" is left to the imagination. If it means that the whole of works A in a town should close for one period, works B for another, while works C took yet a different one, much could be said in favour of the proposal, albeit something could be argued against it. If, however, it involves coming down to the individual, the suggestion cannot readily be accepted. It is a common practice for officials to arrange a "leave roster," so that there are not too many heads of departments away at the same time, but even if it be an established custom, it may not necessarily be a sound one, for it might prove a good idea to have all the heads away together, and let their deputies stand on their own feet and show what they are capable of doing in the way of running the organisation, while at the same time the period of relative dislocation would be reduced to a minimum.

In order to accede to the wishes of a Government Department, some works evolved an elaborate system of staggering holidays from the highest official down to the lowest manual worker, but it had to be admitted that such an arrangement was responsible for a great deal of inconvenience, and that output was adversely affected over an extended period, so much so that some firms resorted to the bold expedient of abandoning the idea and reverting to their pre-war practice. When it has been agreed that holidays are essential, there is little doubt that output in an industrial undertaking suffers least by a complete shut-down. This has the important additional advantage that it leaves the maintenance squad free to spend the whole time on an intensive overhaul of the entire plant without let or hindrance. Accordingly, let us take our holidays with a clear conscience, and let us give them willingly and with a good grace to all who may be working for us, realising clearly that by so doing we are furthering and not in any way impeding that national effort which is so essential to the victory to which all are looking forward.

Obituary

ENGINEER-CAPTAIN JAMES FRASER SHAW, R.N. (Ret.)

BRITISH fuel research has lost one of its leading workers by the recent death, at his home, 13, Lower Camden, Chislehurst, Kent, of Engineer-Captain J. Fraser Shaw, who has been in charge of the Fuel Research Station of the Department of Scientific and Industrial Research at River Way, East Greenwich, since its inception. Captain Shaw, who was sixty-two years of age, was born at Cornbrook, Trafford Park, Manchester. He was educated at Old Trafford and later at King William's College in the Isle of Man. In 1893 he entered the Royal Naval Engineering College and from 1898 to 1915 he served in many naval ships. During the last war he was the senior engineer in H.M.S. "Invincible" in the Falklands battle, for which he received special promotion to the rank of Engineer-Commander. In 1917 he was appointed to the Admiralty for special duty with the Ministry of Munitions, and at the end of the war he was seconded from the Royal Navy on account of his special knowledge to take charge of the Fuel Research Station. In 1923 he was appointed Engineer-Captain.

From the very beginning Captain Shaw played an important part in all the research work which was carried out at the Station, and its success has been due in a very large measure to him. As our readers will know, the Fuel Research Station is equipped with experimental plants which are in every way comparable with those actually in use in industry. Captain Shaw was responsible for the design and operation of many of these experimental plants, in particular those for low-temperature carbonisation, and the hydrogenation of coal. He was able to operate these plants in such a manner that scientific information of great accuracy was obtained, which could be applied to similar plants in the fuel industry.

In his many years at the Station Captain Shaw endeared himself to the staff, and the perfect relationship between the industrial staff responsible for the operation of the plants and the scientific staff who were engaged on the actual experiments was his particular interest. He brought into perfect harmony deep scientific thought and its application on a large scale. The loss to the fuel industry caused by his death is irreparable, but he will long be recalled by his sterling work and his kindly nature, and the valuable record he has left in the publications of the Fuel Research Organisation.

SIR JOHN PRIESTMAN

IT is with regret that we have to record the death at his Harrogate home, "Tyringham," Rutland Road, on Tuesday, August 5th, of Sir John Priestman, who was widely known both as a shipbuilder and industrialist and a public benefactor. It is recorded that Sir John has, in recent years, given not much less than £500,000 to social and religious causes. He was born at Bishop Auckland eighty-five years ago, and came of a working-class family. At an early age he was forced to leave school to earn his living, and was apprenticed with the Sunderland firm of John Blumer and Co. From the shops he passed to the drawing-office and became a skilled draughtsman acting at a later date as chief draughtsman for two important firms on the Wear.

It was in 1882 that he founded the firm of Priestman and Co. at Southwick, Sunderland, of which he was the sole proprietor. His enterprise was rewarded and the firm succeeded and built many ships. Besides his own yard, Priestman became interested in shipping and many other commercial undertakings in the North of England. He was the chairman of the Enfield Steamship Company, of Sunderland, the Cliffside Steam Ship Company, and the Brinkburn Steamship Company, of Sunderland. For many years Sir John took an active part in the affairs of Sunderland and for twenty years was the Chairman of the Southwick District Council. One of his gifts was the library at the Sunderland Technical College, with which he was closely associated for many years. He received a knighthood in 1923 and was created Baronet of Monkwearmouth, County Durham, in 1934. In recognition of his many benefactions the freedom of Sunderland was conferred upon him in 1933. He was a keen organist and made gifts of organs to many churches.

Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

A RISING COAL OUTPUT

SIR,—In opening the recent House of Commons debate on the coal situation, the Secretary of the Mines Department, Mr. D. R. Grenfell, attributed the insufficient output to shortage of man power; "over 100,000 men have left the industry since the war, 75,000 of whom have gone in the last twelve months." In the course of his reply to the debate, the President of the Board of Trade, Sir Andrew Duncan, said: "I do not believe that the view that it is impossible to increase output with the existing personnel is true, nor that it is held throughout the mining industry," while Mr. G. Griffiths spoke of "the unrest in the mining industry" and suggested that "if the miners were given a square deal and a square meal their confidence would return and production would increase." Apart from the release of ex-miners from the Services, therefore, the possibility of increasing the output per man is worth considering.

Comparatively few men work in or about a coal mine by choice. They take on the job for wages—for a living and hope against hope for a better living. If each coal face worker were paid at piecework rates, or according to the weight of coal he despatched to the pit's head, he would, unless he were thriftless, have a real inducement to harder toil and sweat. British miners would undoubtedly excavate more coal week by week than they had ever done before.

As every colliery expert knows, however, this popular panacea for improving output is not generally applicable to mining operations, mainly because the quantity recovered per shift varies with and depends on the character of the seam and may therefore decrease through no fault of the miner. Nor does an attendance bonus, the Government's latest deterrent for absenteeism, provide a direct incentive to production. Like a fixed weekly wage for the dockers, an attendance bonus does not necessarily promote a higher efficiency.

Since payment by individual results is impracticable, the problem of stimulating the output of coal appears to be insoluble, yet it can be solved providing the Board of Trade is prepared to take further steps in social and industrial reorientation for the intensification of our war effort.

The cost of producing a ton of coal depends fundamentally upon the miners' rate of wages. There are, of course, additional costs, such as the wages of surface workers, the cost of maintenance and repairs, as well as overhead charges, but their cost per ton tends to fall as the output rises. Thus the problem which faces the Government boils down to this. To make any and every advance in the wages of all colliery employees—coal face workers, surface workers and staff—synchronise with an increased production of coal.

Let us assume that the wage of a miner averages £4 per week (coal mining is not only a deuced unpleasant but a hazardous occupation); that a given colliery yields 10,000,000 tons of coal yearly; that the price of this coal at the pithead is fixed at 10s. per ton (in wartime prices are not left to the mercy of supply and demand and price control is quite the fashion); and that at this level of production and at this price the colliery shows a net annual profit of, say, 5 per cent.

Let us now suppose that, with the same number of miners and at an unaltered selling price, the output of our colliery is increased by 10 per cent., or 1,000,000 tons per annum. Since the advance in costs would be relatively small, there would result an additional net profit of some £450,000. Deducting a percentage for the mine's shortened life and allowing a few per cent. as a solatium for the shareholders and management, who are also members of the community, there should remain for disposal a sum of at least £400,000. This sum has been earned through the exertions of the colliery's employees, and through no other means. It must therefore be distributed among them as profit wages.

A participation in the profits of industrial undertakings or payment by collective results is, of course, an ancient device for securing the goodwill of wage earners, obviating strikes and stimulating production. Robert Owen introduced co-partnership into his textile mill with a great flourish of trumpets more than a hundred years ago, but the early collapse of his scheme created an enduring prejudice against its general adoption. This prejudice is not based on reason. It has no justification, because the conditions under which Owen's nineteenth century experiment was conducted made its failure inevitable. In the first place, his operatives did not "go to it" because this Socialist insisted on paying identical wages to his workmen whether they were good, bad or indifferent. In the second place, the textile industry had not been rationalised, and trade depressions brought about by an over supply were constantly arising. So soon as trade became bad, therefore, rival manufacturers began to cut their prices, and, since Robert Owen had dissipated his reserves, he was heavily handicapped and went under to the relief of advocates of the policy of *laisser faire* or muddle through.

In order that the sharing of profits among industrial employees may achieve its purpose permanently, the first essential is a practical certainty that profits will materialise, and this is not feasible unless supply and demand have been balanced, through the planning of production, unless co-operation among manufacturers has been substituted for competition, and unless producer prices have been fixed, all of which measures towards industrial stability are already being enforced to some extent in this total war. It is also essential that a participation in the profits of industry be made obligatory.

A number of voluntary producer profit-sharing

schemes are successfully operated by monopolistic undertakings in the United States, but in Great Britain almost the sole considerable example extant is that of the Gas Light and Coke Company. In normal times this utility company is a very regular dividend payer, because it has a practical certainty of selling the whole output of its main product—gas—at a price fixed by statute. On the other hand, there is clearly less scope for augmenting profits in a gas-works than in a coal mine or a progressive industry, yet the governor of the Gas Light and Coke Company maintains that "the argument commonly used against co-partnership, that the benefits are not large enough to effect any good purpose, shows a want of imagination." Indeed, it is undeniable that most men will work more contentedly and better when they are guaranteed a benefit from the result of their collective efforts; when they are, in effect, co-partners.

There remains the factual difficulty that some coal mines are easier to work or more profitable than others; but the solution is not far to seek. A proportion of the profit increment accruing to the fortunate pits must be allocated to a general profits equalisation fund. Men employed in difficult pits would be entitled to draw a share from this fund. In its concentration and telescoping of industries the Board of Trade has, at long last, taken active steps on these lines. Nor can those challenge this procedure who lay stress on the solidarity of the workers, or social security, or equality of sacrifice, or even on the mutual obligations to one another of the members of a civilised society.

For the assurance of a rising coal output there is no other way open to a democracy, as has been made manifest by Communistic inefficiency and Nazi slavery, than rising colliery profits coupled with the participation therein by all concerned.

Bexhill, August 8th. J. S. Hecht.

SHORTAGE OF ENGINEERS

Sir,—Mr. S. J. Potter's letter in your current number rightly calls attention to the exclusion of engineers from technical administrative posts by reason of their not being experts in one particular branch. A much more objectionable "Bar Sinister" is the ruling out of all except favoured applicants for being over the age of fifty or so. Are politicians the only persons who retain their efficiency after that age?

It is reported that Mr. Bevin is going to establish a training school for converting young fitters and turners into managers and turning them out fully qualified, like chickens out of an incubator.

Has he never thought of applying to the Central Register or to some of the great engineering institutions, or even of inserting an advertisement: "What do I do if I want an experienced and properly qualified engineer?"

It is notorious that many good experts are out of work and their life's experience being wasted.

August 6th. Old Hand.

RECOVERY OF NATURAL GAS FROM COAL

Sir,—The presence of very considerable volumes of methane stored in the coal measures is, of course, known, but not to the extent Mr. Ranney visualises, nor have the means of economic abstraction been discussed, so far as I am aware.

To the coalowner the utility of methane may be a doubtful factor. At a cost of 2½d. per 1000 cubic feet the displacement of solid boiler fuel may be envisaged, but offers little inducement. Likewise, distribution for domestic or industrial purposes entails an exacting and complex contract. If the gas be liquefied the complexion is completely altered, for we have then a high-grade aviation spirit suitable for vehicles and aeroplanes, and within the Government subsidy for home-produced fuels.

As my firm, with other collaborating interests, has devoted some time to the problem of the economic utility of marsh gas in the liquid phase, the appended data may be of value:—Weight and volume, 1000 cubic feet = 42·3 lb. = approximately 10 gallons (4·15 lb. gallon); calorific value, 90,000 B.Th.U. per gallon; permissible compression ratio, above 10/1; power consumption per gallon, less than 2 kWh; evaporation loss from vacuum tank of 20 gallons capacity, less than $0 \cdot 002 \times 20$ gallons per hour.

The spirit conforms to the highest octane value; it has been tested in motor vehicles and is producible for research purposes on a reasonably modest scale.

In the liquid state it can be transported in bulk by suitable tank lorry. The evaporation loss is then less than the figure indicated, but as the vehicle would be using the gas for power purposes this may be completely neglected, so that the delivered cost over a radius of 100 miles or more is such as to enable effective competition with town gas to large industrial users, when relatively small evaporation loss can always be employed for some useful purpose.

Our aim is, of course, coke oven gas, in the separation of which hydrogen becomes available at a lower cost than *viâ* other sources, thus opening an entirely new field for development.

To ascertain the available methane in our coal seams requires some care, and the mining engineer will probably inform us as to the possibilities of blocking out areas. Where the gas is present in volume adequate for exploitation, its removal influences ventilation costs and probably the choice of explosives, given proper means of avoiding coal dust when blasting is in progress. I have not probed the problem of selective adsorption in the reverse sense for storage (1000 cubic feet per ton of coal), and its application is strictly limited. As is well known, activated coke adsorbs over 10 per cent. of its weights of benzol.

In conclusion, one would like to present the Government with the increase in national wealth represented by over half our imports of motor spirit, which a conservative estimate of oven gas and potential coal adsorbed gases indicate given the desire of the motor trade to foster a new technique, viz., the use of a gas boiling at minus 164 deg. Cent.

London, August 9th. D. Bagley.

CONTRA-PROPELLERS

Sir,—It is now reported that for stratosphere flying a twin propeller arrangement with the screws in tandem has been found highly efficient. The Italians adopted this device several years ago to win the speed record, but it dates, in the writer's knowledge, far further back, for in 1914 he demonstrated the Redrup motor to one of our biggest armament firms, unfortunately without success.

The Redrup motor combined principles of the rotary engine, like the Gnome, with that of a radial design; that is to say, the crankshaft was free to revolve in the crank case and the crank case was free to revolve round the crankshaft, and with a right and left-hand propeller coupled to them respectively reactionary torque was balanced and the motor was so free from vibration that the small demonstration 3 H.P. set could be held on the knees while running all out, the demonstrator leaning back to a suitable angle against the pull of the propellers.

I wonder how many of the gentlemen who saw this demonstration in 1914 realise what they lost when they turned down what was then by far the lightest aerial motor in the world, or to what the system might have developed had it been supported. However, possibly it is not too late. No invention to-day is "dated" except by the market conditions which oppose its launching, and to-day we are far too keen on beating the Hun to let any "vested interests" stop development. I cannot say whether Mr. Redrup the designer, is still available, but if he is, certainly his experience in the balanced torque motor should be of service to the nation. S. P. Christie.

Chichester, August 9th.

CONTROL OF FACTORY AND STORAGE PREMISES

We have received from the Board of Trade a full list of the Regional Officers connected with the carrying out of the Order referred to in one our Journal notes of last week. They are as follows:—Northern Region: Northumberland, Durham and Yorkshire (North Riding), 34, Grainger Street, Newcastle-on-Tyne; telephone number, Newcastle 28831. North-Eastern Region: Yorkshire (East and West Ridings), Woodville House, 29, Vesper Road, Kirkstall, Leeds, 5; telephone number, Headingley 54107. North Midland Region: Derbyshire, Nottinghamshire, Lincolnshire, Leicestershire, Northamptonshire, Rutland, Dudley Lodge, Peveril Drive, Nottingham; telephone number, Nottingham 41025. Eastern Region: Cambridgeshire, Bedfordshire, Huntingdonshire, Norfolk, Suffolk, those parts of Hertfordshire and Essex not included in the Metropolitan Police Area, G.F.S. House, Park Terrace, Cambridge; telephone number, Cambridge 56206. London and South-Eastern Region: The Metropolitan Police Area, Surrey, Kent and Sussex, 25, Victoria Street, London, S.W.1; telephone number, Abbey 3206. Southern Region: Oxfordshire, Buckinghamshire, Berkshire, Hampshire, Dorsetshire, Burberry Buildings, Mill Lane, Reading; telephone number, Reading 4851. South-Western Region: Gloucestershire, Wiltshire, Somersetshire, Devonshire, Cornwall, 11, Chantry Road, Bristol, 8; telephone number, Bristol 37604. Wales: 10, Cathedral Road, Cardiff; telephone number, Cardiff 5803. Midland Region: Staffordshire, Warwickshire, Worcestershire, Herefordshire, Shropshire, Somerset House, 37, Temple Street, Birmingham, 2; telephone number, Midland 3076. North-Western Region: Cheshire, Lancashire, Westmorland, Cumberland, Lombard Chambers, 46, Brown Street, Manchester; telephone number, Deansgate 2578. Scotland: 95, Bothwell Street, Glasgow, C2; telephone number, City 6511.

Sixty Years Ago

A New Railway and an Old Ship

In our issue of August 12th, 1881, we called attention to a recent advertisement issued by the Canadian Government in which it was announced that a homestead of 160 acres would be given free to every settler in Manitoba and the North-West. The Canadian Pacific Railway, the advertisement continued, was being pushed westward at the rate of 300 miles annually, and would ultimately open up 150 million acres of the best wheat land in the world, together with 50 million acres of the best grazing ground, available all through the year. . . . In the same issue we reported that the steamship "Great Britain," lying in the West Float, Birkenhead, had recently been offered for sale at Liverpool. This famous ship, designed by the younger Brunel and launched at Bristol in 1843, was the first large ocean-going screw-driven iron steamship. For many years she was employed in the Australian trade, in which she made some rapid passages, and she also did good service as a troopship. In the particulars published in connection with her sale at Liverpool she was described as a vessel of great structural strength and as being admirably adapted for the cattle trade across the Atlantic, her high 'tween-decks and side ports affording "grand ventilation." She would be able to carry livestock on three decks. Her beautiful lines, it was added, peculiarly fitted her to be altered to a sailing ship. With her machinery removed, she would, it was calculated, carry upwards of 4000 tons dead-weight. Her length was 325ft. and her breadth 50ft. 6in., her depth being 31ft. 5in. The biddings began at £2000 and went up to £6500. There being no advance on that figure, the steamer was withdrawn from sale.

Swedish Substitute Products

War interferes very seriously with the development of peacetime products. But its effects even in that field are not wholly bad, especially in the case of a country happy enough to have been able to remain neutral, although seriously handicapped by the efforts of the belligerents to harm each other. A case in point is Sweden, where there was recently held the Göteborg Fair. Owing to our blockade and to the effects of the war in other parts of Europe, Sweden is unable to obtain many important products from abroad. Substitutes of various kinds have therefore had to be developed, and in several cases it is likely that they will prove of value when the war is over. Sweden is particularly rich in forests. Hence, as might be expected, many of the substitute products are made from wood. Certain textiles made from cell-wood are expected to maintain their importance when peace returns. Many kinds of uses are being found for paper and a plastic paint and a kind of glue are being developed from the waste products of sulphite mills. Coal and oil are scarce, and consequently great efforts are being made to utilise other fuels. Electrically driven cars and three-wheeled cycles were shown at the Fair, and the need to make the best use possible of the oil available has led to the production of small and low-priced oil cleaners. Producer gas generated from charcoal or wood has become, of course, the chief substitute for petrol and oil, particularly for vehicles and the smaller boats. After the war it will be interesting to see in what respects Swedish designs differ from those developed elsewhere, and whether they have achieved a greater success. Wood and peat have also had to replace coal and coke as fuel, and, in consequence, special types of furnaces, grates, and even boilers appear to have been developed. The burning of peat beneath boilers is accompanied by many technical difficulties, and it will be of interest to many countries to discover when the war is over what degree of success has attended Swedish efforts to overcome them.

U.S. Army's Air Freight Scheme.—The Fiftieth Transport Wing of the U.S. Army Air Corps, which was started in 1935, has now become in effect a "freight air line" and operates between such widely spaced towns as San Antonio (Texas), Los Angeles and Sacramento (California), Fairfield (Ohio) and the Panama Canal. According to *Flight*, its fleet consists of about forty Douglas "C33" and "C39" aircraft, which are cargo versions of the "DC3" type, having specially large doors. Engines for repair and urgently required spares make up a large proportion of the cargoes. Airscrews are carried outside, fastened to the underside of the fuselage. The reduction of speed so caused is about 10 m.p.h. Up to 3200 lb. can be carried, but the usual load averages about 2000 lb. Official passengers are also carried. During the first half of last year nearly 3½ million pounds of cargo and 2000 passengers were carried, and flying time totalled over 16,000 hours.

Depreciation of Industrial Assets

(*Contributed*)

No. II

(*Continued from page 87, August 8th*)

THE two methods of depreciation stated in our first article will usually be sufficient for most machinery in industrial concerns, but where the outlay runs into some thousands of pounds, as in chemical industrial plant and in many municipal engineering enterprises, the sinking fund and annuity methods must be adopted—that is, as a rule.

Where the assets are costly to replace—machinery and plant costing, say, £500,000—there is naturally no wish to disturb the money position when a similar sum of money is called for to replace this plant in its entirety. Provision must therefore be made on a serious basis, and it is usual to use the sinking fund method by which a yearly sum of money is invested in securities outside the industry, so that, at compound interest, it will accumulate to the desired sum over seven, ten, fourteen or twenty-one years. Needless to say, the directors will select gilt-edged securities.

But the insurance policy system could be chosen instead of the above, the yearly provision being looked upon as the premium paid to secure an endowment policy "insuring" the "life" of the asset on the agreed number of years. This is a rather popular method of providing for depreciation, because it saves the directors the trouble of searching for suitable investments; again, in the sinking fund method the securities have to be realised at the end of the period, and there may be some loss owing to the disturbance of the market. With the insurance policy method no loss can arise, since a definite sum of money is paid on a definite date.

The annuity method provides for a yearly sum of money to be invested in the business, thus increasing its working capital. On these sums of money lent to itself compound interest is charged. This method is very suitable for "writing off" such things as leases or sums of money given for goodwill, since the calculations cannot be rendered more complex by any yearly additions. These assets are treated as single straightforward problems, so that the calculations made at the start serve throughout the full period of seven, ten or any other number of years—even sixty, if thought necessary.

Operation of the Sinking Fund Method

Interest is an important factor here; there may be a fair sum of money involved and before the business requires any replacement a period of time like ten, fifteen or twenty years may have elapsed. The chief point to consider is that at the end of, say, fifteen years the business requires the sum of £50,000 for replacement of plant. In the sinking fund method this sum is accumulated outside the business for the simple reason that the management will not wish its working capital to be disturbed when that day arrives.

The calculations take into account the compound interest earned, and this makes the matter more complex. But because of the compound interest earned, a smaller yearly provision is called for than would be the case if interest were ignored. If our plant cost £50,000 and its scrap value was £3000, we have £47,000 to find at the end of, say, fifteen years. Ignoring interest, this would mean a yearly provision of £3133 6s. 8d. per annum, but if we take interest at 5 per cent. per annum and compound interest, we should be obliged to provide only £2178 1s. 5¾d. Here we may almost ignore the shilling and pence in providing such a very large sum of nearly £50,000.

In working out these calculations we must have a book of tables and we may mention one—in the footnote—which will be found very useful,* for formulæ and the method of using them.

Method of Recording Depreciation.—Engineers will be interested only indirectly in the accountancy side of this work, but while it will be unnecessary to show examples of accounts, it will be helpful to add the following notes :—

(1) This yearly provision of £2178 1s. 6d. is the value of the depreciation charged against profits and debited to profit and loss account, and credited to sinking fund account.

(2) This sum is, of course, invested outside the business and has to be paid out in cash for investments. Cash account is therefore credited and investment account debited.

(3) Interest arises in the second and subsequent years; this, being earned from an outside source, is a receipt and is debited to cash account and credited to the sinking fund account.

(4) But the business does not receive this cash, actually, for it remains in the investment account, which is debited with it, and, to complete the double entry, it is credited to cash account, as though "paid out" in cash again.

The investment account denotes the holding of gilt-edged securities, growing larger each year with interest and the yearly instalment. Its value is placed as an asset in the balance sheet. This is balanced by a similar amount in the depreciation or sinking fund account in the liabilities on the opposite side.

Annuity Method of Depreciation.—In spite of the fact that the annuity method is considered scientifically accurate, it has several disadvantages, as :—

(1) The yearly provisions are retained in the business as extra working capital, but as the "fund" grows they are not likely to be retained as cash because they are earning profits.

But when the date arrives for the replacement of the asset, will the cash be readily available for the new purchase to be made, without any serious disturbance of the financial position?

(2) Where groups of machines or units are likely to be replaced every two or three years—not in one large sum at the end of seven or ten years—cash would always be available for these small replacements. But owing to the complex nature of the calculations the method is largely reserved for "depreciation" of leases, goodwill or of freehold buildings, simply because there are no additions made at any date and one calculation, made at the start, prevails throughout the life of the asset.

Keeping close to our example for the sinking fund method, above, let us suppose we have to calculate by the annuity method the yearly provision to accumulate £47,000 over a period of fifteen years at 5 per cent. By consulting a book of tables we find that £1 will purchase an annuity of £0·0963423 for fifteen years; we multiply this decimal by 47,000. Our answer is £4528 1s. 9d.

The method is operated by records as follow :—

(1) The plant costs £50,000 and we estimate that the scrap value of it will be £3000. We plan to reduce this £50,000 to £3000 by providing a yearly instalment of £4528 1s. 9d.

(2) Interest is charged on the £47,000 at 5 per cent. and this sum is reduced by subtracting the yearly sum of £4528 1s. 9d.

The reduced balance the following year will earn less interest, but there will still be the same deduction of £4528 1s. 9d. This will continue for another fourteen years, and by that time the yearly depreciation will just be equal to the balance plus interest for the last year, at least, so we hope. It will be near enough for all practical purposes to the residual value, namely, £3000.

(3) As time goes on the business reaps a substantial benefit from the loan of this money, chiefly in the last five years, at a time when small interest is being paid on the reducing balance.

(4) The revenue or profit and loss account is debited with the yearly charge—£4528 1s. 9d.—and is credited with interest at 5 per cent. on £47,000, namely, £2350, for the first year.

This being so, the net charge against profit is the difference, £2178 1s. 6d.

Each year after the first the interest gets less and less, but the depreciation charge is fixed at £4528 1s. 9d., so that the net amount against profits increases.

The calculations are worked out from standard formulæ using "logs" to cut down the work of multiplication and division. A book of tables—even if its price is high—saves time and money in the long run. Most people will not be anxious to do any more of this work than is absolutely necessary, and will therefore use the annuity method for writing off leases or freeholds, goodwill values and possible trade marks which are associated with the goodwill. It is convenient to apply it to machinery, for :—

(1) If the number of machines is small and there are additions each year, each item requires a separate calculation.

(2) If the machine is costly there is one calculation at the start, but the sinking fund method is better because the fund is accumulated outside the business. The insurance policy method is also recommended.

The Insurance Policy Method

This is a popular method, chiefly because there are no calculations to be made, except by the actuaries of the insurance company, and they are well versed in this rather difficult work. Another point worthy of note is that there can be no loss upon the realisation of the investments at the end of the term. The work is very similar to the sinking fund method, and the entries in the books are much the same. The following points might be noted :—

(1) The yearly premium paid is the depreciation for that year and is debited to profit and loss account and credited to depreciation fund account.

(2) As the premium is paid out in cash the cash account is credited and the policy account debited.

(3) The value of the policy account will be found on the assets side of the balance sheet, with the corresponding depreciation account among the liabilities on the other side.

Some day the policy matures and cash is received from the insurance company. This calls for a debit entry in the cash account and a credit entry in the insurance policy account. The insurance company will usually pay compound interest on the sums received, say, at 2½ per cent., so that more will be received than the total of premiums paid.

These three methods can be used for capital redemption schemes, repayment of debentures in a company and for extinguishing debts over periods of twenty, thirty to fifty years. The building up of these funds gives added strength to the financial position as shown by the several balance sheets. For example, when a high price is given for the goodwill—and supported by private formulæ and patented processes—it is never a good plan to let this goodwill figure stand in the balance sheet at its original sum for years. It should be "written down" gradually over a period and, as there is no outlay for replacement of this asset, the method adopted should be the annuity scheme.

The Revaluation and the Depreciation, Repairs and Renewals Methods

In engineering establishments it is the custom to keep a register of machinery and plant; every machine will be found in this register and the details usually recorded there are :—Name and make of machine, name and address of suppliers, the position of the machine in the factory, its number, cost of all repairs, details of the yearly depreciation, &c.

The register may be a loose-leaf book or a card index cabinet. One of the most useful means of accommodating these records is to have folding cards which are set in trays, each card overlapping the other like the tiles or slates on a roof. There is an exposed margin on the lower edge of each card, and along this edge are typed the name of the machine and its number. The number is stamped on a brass plate and this is fastened to the machine.

This lower edge of the card is also arranged for the operation of coloured signals which give special details of the machines as follows :—

(1) Red signal, "Machine undergoing repairs";
(2) Blue signal, "Machine due for overhaul";
(3) Black signal, "Breakdown of the machine";

and so on. The chief matter of importance in using these signals is that the chief engineer, by one glance at the trays of cards, can pick out the black signals and so note the number of breakdowns. Then he can "take in" the number of red signals and note the machines undergoing repairs; lesser matters can be dealt with later. These are all matters of detail which can be left to every industrial management to handle as it best pleases, so we just make mention of it here and pass on to those very small items which do not merit a place in the machinery register.

Items for Revaluation

This method is a kind of annual stocktaking job, and if the value at the end of the year is less than at the beginning then the deficiency is charged against the profits for the year as a kind of depreciation.

* "Repayment of Local and other Loans," by E. H. Turner, A.C.A. 536 pages. Messrs. Sherratt and Hughes, Park Road, Timperley, Cheshire, Publishers to the University of Manchester.

This is how the depreciation is arrived at for such things as :—

(1) Type, in a printing establishment ; patterns and moulds, in a foundry.

(2) Small plant, in any machine shop.

(3) Loose tools, dies, drawings, and the like.

(4) Trade marks and patents, in certain cases. However, these things are so intimately associated with the goodwill of the business that it may be advisable to use the " straight-line " method of depreciation, chiefly in the case of patents which have a legal period of life of fourteen years.

Nevertheless, it may be advisable to have a five-yearly revaluation as a check on the book values.

(5) Packing materials generally. Many firms which make machinery for export must spend a fair amount of money to pack it carefully. Such packing materials are cases, casks, crates, waterproof sheeting, bolts and nuts, hoops and numerous other things. Electrical testing instruments are small and very costly, and in packing them for export and for the home market some rather expensive cases are used.

(6) Investments in industrial and commercial concerns.

The Operation of the Method

This method is outlined as follows :—

(1) Open an account for a group of these assets as named above as " Type Account," " Loose Tools Account," " Patterns, Dies and Moulds Account."

(2) Debit the account with the value as brought down on the first day of the trading period. Add to this the value of all the additions during the year.

(3) Credit the account with the proceeds of the sale of scrap or obsolete tools.

(4) Again, place the new valuation figures at the end of the period on the credit side. If there is a deficiency debit to profit and loss account as the depreciation for the year.

(5) Bring down the balance—the new valuation —as a start for the next trading period.

Depreciation, Repairs and Renewals

This is an effort to try and get at an equal annual charge throughout the period ; this charge is to cover the estimated depreciation and the cost of repairs and renewals throughout that period. If a machine cost £950 and at the end of ten years its scrap value is £50, then we must provide £90 per annum for depreciation. This is really the " straight-line " method.

But there are repairs and renewals to consider. What will they cost for ten years ? They will be light in the first few years and heavy in the last three, and we have to try and get a figure which will spread this expense per year equally over the period named.

It often happens that expenditure for renewals, being viewed as distinct from the usual repairs, is charged up as a capital expense, but this is a mistake. Such renewals cannot be said to increase the capital value, but are just simply those things which enable the machine to " carry on doing its bit." These renewals must therefore be grouped in the " upkeep " of the machine ; they are charges of a revenue nature.

The Operations of the Fund.—The account is usually named " The Depreciation, Repairs and Renewals Fund Account," and the records are entered as :—

(1) Credit the account with the yearly " depreciation " as calculated to cover the whole three items.

(2) Debit the account with the cost of any repairs and renewals. There will be a balance to bring down for the next period to which will be added that year's " depreciation."

(3) Each year the balance brought down gets greater, until at the end of the term it approaches the amount required, namely, that required to make good the loss by depreciation and sufficient to replace the asset in question.

(4) It is not likely to be accurate, because the all three aspects of expense over the period are purely estimates and may have to be revised and more or less may have to be charged, as seems best, at intervals.

Discussion of the Legal Position

It is sometimes contended that where repairs and renewals to machinery are carried out carefully and charged up each year against the profits it is hardly necessary to pay too much attention to the subject of depreciation. It would be nearer the truth to say that where such repairs are carried out under the best conditions the machinery will last longer under that phase of depreciation known as " wear and tear."

This being so, one may spread the provision for depreciation over ten years instead of seven, or fourteen years instead of ten. But the provision will nevertheless be necessary, because the work done under " Repairs and Renewals " simply keeps the machine in good trim ; it is still necessary to provide for its replacement in ten, fifteen or twenty years' time.

It is a matter of commercial prudence to provide for the depreciation of the fixed assets in any industrial concern. It cannot be said that any one-man business, partnership or even any local authority is legally bound to make this provision. The law is more complicated in relation to public limited companies, but it would appear that such companies can, if they wish, pay away profits in the form of dividends without providing for the depreciation of their fixed assets, but they would be bound by the wording of their articles of association on this matter.

With regard to the depreciation of " floating " assets, any deficiency should be made good before any of the profits are paid away in dividends. Of course, unless proper depreciation is made, chiefly as the auditors may advise—and may also report to the members of the company—it is difficult to see how one can arrive at an accurate profit figure.

Again, the balance sheet figures, as valuations, cannot be said to be correct at the date named, unless depreciation is taken into account, and as time goes on from year to year the omission of depreciation would leave the assets at inflated values, a matter which could not be viewed as other than serious, particularly when it is known that larger profits are being paid away in dividends than are justified.

Rates of Depreciation.—The Board of Inland Revenue has compiled a table of " wear and tear " allowances for most industries ; these are the agreed rates allowed in computing liability to income tax. A copy of these tables, as reprinted by the *Accountant*, may be obtained from the publishers† for a matter of sixpence or so.

It should be noted that these tables are used for making adjustments for income tax, but they are below the rates usually adopted for commercial purposes. Where machinery is being operated day and night, instead of the usual working day, an extra rate should be applied for in adjusting the company's profits for income tax purposes. Again, an intricate machine in a specialised type of industry should be depreciated at a higher rate than the usual (1) engines, boilers and shafting, 5 per cent.; (2) general machinery and plant, 7½ per cent.; (3) motor vans and lorries, 20 per cent. on their written-down values.

To take one example, motor lorries, which are given in these tables at " 20 per cent. of the written-down value." This is not the same as 20 per cent. of their original value. Most transport experts will agree that a depreciation of 20 per cent. of the original value of a motor lorry per annum, is the minimum that would be advisable ; some would increase this and " write off " the motor vehicle completely in four years. Now this is well above the allowance mentioned in the tables compiled for income tax adjustment of profits, for each year after the first as the written-down value becomes less and less the percentage for depreciation also becomes smaller and smaller.

Income Tax Allowances.—The allowances as given in the tables—take the motor vehicle as an example—can be viewed as purely physical " wear and tear." But this physical deterioration is only one phase of depreciation as looked at from the point of commercial prudence. The other phase—quite important in many instances—is obsolescence, for machinery may not wear itself out physically ; it may have to be superseded because it is an old model and has nothing like the productive power of the new model.

Productive power is important in industry, for if the rate of production can be increased by 50 per cent. without any appreciable rise in fuel or power costs and, let us say, with a saving of labour on the present machine, the problem of replacement will appear advantageous to any management. Hence arises the replacement of the machine owing to obsolescence, and this is largely the cause of the difference between the allowances given by the income tax authorities and those annual depreciation figures used in industry by the various managements.

Depreciation and Costing

Depreciation is an on-cost item and is taken as a works expense in the operation of costing. Being a definite charge against each year's profit, according to the several methods suggested in these articles, it is just as much a production cost as repairs or as the numerous other items of on-cost. It is of an " indirect " nature, a class of expense that cannot be charged up to any definite job, but must be spread over the total factory output.

Being one of the factory overheads, it can, with like expenses, be worked out as a percentage on the prime cost, on the direct wages paid, on the manual hour rate or the machine hour rate, the last-named basis being usually agreed upon in factories where machines, rather than manual labour, are the chief factors in production.

Revaluations and their Problems

We have mentioned the revaluation method of arriving at the value at the end of any trading period of such small items as loose tools, patterns, dies, type, moulds, packing materials, &c. Doubtless this is a very accurate procedure and it might be thought that it should be adopted for all industrial assets. The method could be used, but with some assets, like machinery, land, buildings and leases, it would be rather costly, because it would mean that at the end of every trading period one would have to call in expert valuers. Expert valuers require fees for their services, fees according to a recognised scale.

This appears to be quite an unnecessary procedure for any continuing business, but very necessary if the business is to be sold or amalgamated. Any of the methods of depreciation we have mentioned in this series can be taken as accurate enough for most industries, and it only remains for the management to decide upon the method to be used.

In the case of expensive machines where the annual depreciation is regulated by the sinking fund or annuity method—over a period of fifteen years—it is an advantage to check the estimated valuation by a revaluation every five years. Since all depreciation by the methods suggested are careful estimates, both as to time of service and as to future residual values, these five-yearly valuations are very useful. The price of the machine may be in the region of £50,000 or more, so that an expert's valuation fee every five years is doubtless worth while, because it checks the book values of these assets and acts as a valuable guide to future procedure. No one can say with any pretence of accuracy that any machine will continue to give good service for fifteen, seventeen or twenty-one years. Nevertheless, from previous experience the estimate may be fairly accurate.

Conclusion

For those who wish to go deeper into the subject than we have done we would recommend the perusal of two textbooks as follow :—(1) " Electrical Engineering Economics," by D. J. Bolton, Chapters I, II and III ;‡ (2) " Principles of Accounting," by S. W. Rowland, Chapters VI and VII.§

The first work contains much more than the cost accountant will require, and the second contains much more than the engineer will find of interest. Both books are excellent for the graphs and formulæ contained therein. The first contains more formulæ than graphs, and the second more graphs and tables than formulæ. Truly, the first is for engineers and the second for accountants.

Another book, " Sinking Funds, Reserve Funds and Depreciation," by J. H. Burton,‖ will be found most helpful to managers, secretaries, and those who are engaged in municipal affairs. It deals largely with depreciation and confines its attention to the procedure of the many entries in the Books of Account, giving many examples that are most useful.

Ore Transport.—Speaking at a railway managers' convention in America recently a prominent railway official placed iron ore first in the list of commodities for defence and civilian use. Up to June 1st the railways had brought to Two Harbours, Duluth, and Superior 13,523,246 tons of iron ore. The highest previous record to June 1st was in 1937, when 10,948,662 tons were brought down. The present weekly rate is upwards of 2,000,000 tons, compared with 1,834,145 tons, which was the best weekly rate in 1929, the year of largest total ore movement. Then the same railways had 22,984 ore wagons, compared with 21,739 wagons at present. The present wagons are larger and quicker dumping ; they are hauled by larger and faster locomotives. Nearly all of the facilities are better than they ever were before, as are the methods of operation.

† Gee and Co. (Publishers), Ltd., Brenton, Osborne Road, Little Heath, Potters Bar, Middlesex.

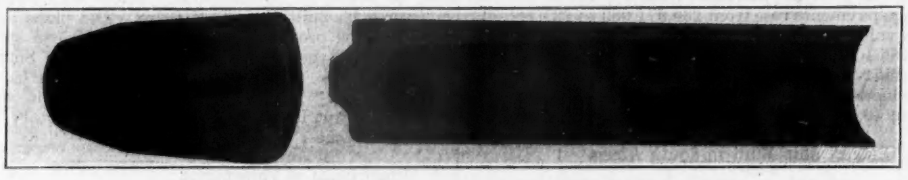
‡ Chapman and Hall, Ltd., 11, Henrietta Street, Covent Garden, W.C.2.

§ The Gregg Publishing Company, Ltd., 51, Russell Square, W.C.1.

‖ Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2.

Shell Production by the Witter Process*

WHEN the Assel cross-roll and elongator mill for processing mechanical tubing was designed and constructed eight years ago by the Timken Roller Bearing Company, no thought was given that it would some day rapidly produce shell forgings for the United States and Great Britain. Yet to-day the Witter shell forging process of Salem Engineering Company, which utilises the Assel mill, is being used by two large companies in the Pittsburgh district to produce large quantities of shell forgings. Furthermore, two mills are in process of construction, and contracts for numerous others are pending.



PIERCED SHELL BLANK FORGING AND SECTION OF ROLLED SHELL

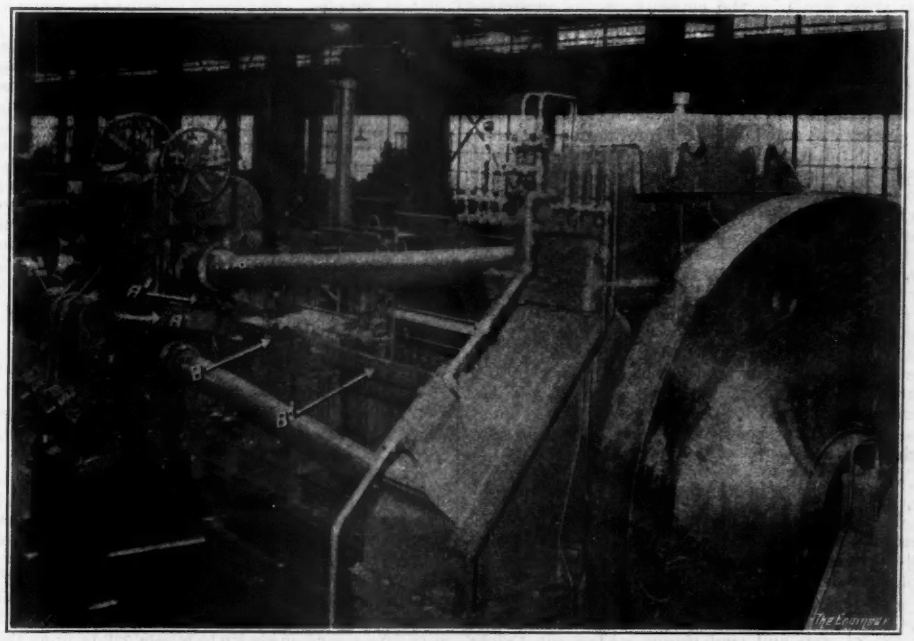
The first Assel mill was designed and built at Canton, Ohio, during 1933 and 1934, and was used in conjunction with piercing mill and regular tube mill equipment operating at the Wooster plant of the Timken steel and tube division. On March 3rd, 1935, the first complete Assel mill started production of 2¼in. o.d. by ¼in. wall mechanical tubing. Hence the original mill, which utilises three humped rolls in the manufacture of tubing, is not very old, and the Witter process, an adaptation of this method for rolling closed and tubular products, is a comparative youngster already showing signs of unusual strength, according to production figures.

Consequently, a proven unit was utilised, and with the addition of mandrel handling and sizing equipment, the processing of closed end projectiles, such as shell forgings, was realised.

Shell forgings were being produced in experimental mills during 1940, and the first Witter process mill began producing shells at a Pittsburgh district plant on January 10th, 1941. This company is operating three Witter process units, and a larger unit is being installed at the present time. The existing mills are producing shell forgings ranging from 75 mm. to 5in. anti-aircraft, while the larger unit will produce forgings ranging from 105 mm. to 7in. Another Witter process unit is making 75 mm. shell forgings at a plant in the Pittsburgh district.

A brief description of the operation of the Witter process follows. Billet steel is properly upset, forged, or pressed to form the pierced blank. This blank is conveyed to a loading station of the finishing mill, where it enters the breakdown pass of the humped rolls with a smoothly machined mandrel inserted in the cavity of the pierced blank. The mandrel is kept bottomed in the blank by pressure from a pushing cylinder, during the breakdown, elongating and cross-rolling operations. On elongating, the metal wraps tightly on the mandrel as it passes through the humped rolls, thus producing a smooth and uniform cavity in the shell forging. After leaving the rolls, the forging is sized with mandrel still inserted, and then the mandrel is automatically stripped, leaving the shell forging completed and ready for machining operations elsewhere. Ten or more mandrels are continuously in use in the automatic cycle, and are properly cooled, thus assuring a uniform production of shell forgings.

Although the Salem Engineering Company originally set up an estimated unit production of 280 75 mm. shell forgings an hour, numerous hourly runs of over 300 and some eight-hour turn productions of approximately 2000, and twenty-four-hour day productions of 5600 have been realised. Short runs on 75s have been as high as seven per minute, and productive averages deducting lost time have been about 275 per hour.



THREE-ROLL ASSEL MILL USED IN WITTER PROCESS

On 105 mm. shells the hourly production has been approximately 287 pieces with eight-hour turn production of 1600.

As a result of recent production speed-ups, Salem engineers believe that with the proper type of blank-producing equipment a maximum of 360 75 mm. shell forgings should be produced in an hour, while even the larger 155s could be turned out at a rate of 160 per hour.

The Witter process has been designed to meet mass production requirements, and employs the use of either round billets or round cornered square billets. It calls for modern heating equipment, a high production blank-piercing press, and the special equipment for rolling to rough turned diameters.

Although Salem contemplated the use of an entirely new mill from beginning to end, the company found that the process was ideally adaptable to equipment already existing in many plants. Not only could a group of single-punch and single-die presses be used to form the pierced blank, but it was found that board or steam drop hammers and conventional upsetters could also perform the same function. Because the finishing mill used in the process is capable of handling not less than 250 75 mm., 90 mm., or 105 mm. shells per hour, and because this type of equipment is expected to be used at its highest production possibilities, Salem believes that a group of presses or a pair of hammers or upsetters should be utilised.

Where ordinarily from sixty to seventy blanks are produced from a conventional press, it would require from three to four such units to provide the 250 per hour necessary for the Witter process. To reach the higher production (Salem is estimating that with proper equipment probably 360 75 mm. shells per hour could be produced) more presses, of course, would be necessary.

DISCHARGE END OF ASSEL MILL

From actual experience it was found that in order to maintain production around 250 shell forgings per hour on the finishing mill, two drop hammers can provide sufficient blanks, and similarly two upsetters could meet that production requirement.

Where no existing equipment is available, Salem has designed and is building a double turret type, high-production, blank-piercing press, capable of supplying from this single unit the entire requirements of the finishing mill.

Using the complete process as developed by Salem Engineering Company, the estimated cost of shell forgings produced on the basis of 250 per hour is 39·50 dollars per 1000. This covers labour and maintenance, but overhead and amortisation costs must be added, as well as other factors, in case existing equipment is utilised in place of the high-speed piercing press mentioned above.

Salem Engineering Company claims an outstanding feature of the Witter process is to be found in substantial savings of material by producing a 75 mm. shell forging from approximately 16 lb. of billet steel, as against 20 lb. utilised by some processes. The machined forging weighs approximately 10 lb. Hence on large-scale mass production, it is said that a weight saving amounting to 20 per cent. would be a decided national defence factor in view of the tight steel situation. This saving in material is also reflected in transportation to the forging plant, machining, and tool costs, and power requirements.

Hourly Shell Output by Witter Process

	Original estimate.	Latest estimate based on production.
Mill No. 1—		
75 mm.	280	360
90 mm.	240	300
105 mm.	200	240
Mill No. 2—		
105 mm.	200	240
5in. A.A.	180	200
5·5in.	160	180
155 mm.	160	160

* The *Iron Age*, July 3rd, 1941, page 51.

South African Engineering Notes

(By our South African Correspondent)

CAPE TOWN, June 26th.

Increased Coke-making Plant at "Iscor"

AMONG the extensions to the S.A. Iron and Steel Corporation's works at Pretoria is a new coke oven battery, which should be ready by October, and will, it is stated, more than double the present output of coke and by-products.

In January, 1934, the first coking plant, consisting of fifty-seven Becker combination regenerative ovens with modern by-products plant, was put into operation at Iscor. Before the construction of this plant was begun, a considerable amount of research had been carried out on coals from various seams in the Union, with a view to utilising as much as possible coking coals from the Transvaal, as railage charges on Natal coals affected very appreciably the final coke cost at Pretoria. It is unfortunate that the Union of South Africa, which is exceptionally fortunate generally in its mineral wealth, has not been so fortunate as regards good coking coal, so that although the coal reserves are estimated at many thousand millions of tons, much the larger proportion is non-coking. It is therefore a matter for careful consideration so as to select those deposits of coking coals which are sufficient in quantity and at the same time situated at the most economic points in relation to the works they are to supply.

In the case of the "Iscor," the Pretoria Steel Works, many coking tests were carried out in an experimental plant erected near Witbank (Transvaal), and valuable information was gained which led to the conclusion that a satisfactory metallurgical coke could be produced from a blend of Transvaal and Natal coals. When the Iscor plant was put to work a blend of 75 per cent. Transvaal and 25 per cent. Natal coal was carbonised, both these coals being washed and having approximately 10 to 11 per cent. ash and 33 to 34 per cent. volatile matter (dry basis). From this blend a satisfactory metallurgical coke was produced, which, although high in ash, gave excellent results in the blast-furnace. Since the beginning of 1939 the Natal coal blend has gradually been reduced, until now under normal working conditions Transvaal coal alone has been coked, still with very satisfactory results at the blast-furnaces.

The new battery of coke ovens for Iscor was ordered in 1939 from the Woodall-Duckham Company, which had supplied the first battery, which consisted of a battery of fifty-seven W-D coke ovens, coal-handling storage, crushing and blending plant, coke screening plant, and a complete by-products plant for recovery of ammonia, motor fuel and tar products. The repeat order is for a battery of forty-five top-charged Becker combination regenerative ovens with a complete coal and coke-handling and by-products plant. It is of interest to note that the designed normal capacity of the forty-five oven battery is approximately 25 per cent. greater than that of fifty-seven oven stamp charged battery previously installed, in spite of the fact that the ovens in the first battery were of the largest size practicable for stamped charged operation. The new battery is capable of carbonising 960 tons of coke a day.

It was decided that whilst carrying out large extensions, certain alterations and additions should be made to the existing by-products plant to bring it in line with the best modern practice, as the scope for the marketing of by-products in the Union is a very important factor from the economic aspect of the Iscor coking plant, and this section has been developed to a very unusual extent for a plant of this size. In this connection, particularly as regards benzol and ammonia recovery, it should be borne in mind that Pretoria is approximately 4600ft. above sea level, and this, combined with the very high summer sun temperatures, presents many problems and difficulties, which are not found in plants situated in more normal altitudes and temperate climates. This position also complicates laboratory distillations and testing generally, and conversion factors must be used.

The by-product plant is being extended as necessary, a new ammonia concentrating plant being installed, the benzole plant being duplicated and equipped for making pure toluole, and a new continuous tar distillation plant is being added, which will increase its total capacity to some 2,000,000 gallons of road tar annually. Every possible care is taken from the point of adequate plant supervision and chemical control to ensure that only first-class tars are distributed as road binders. This has brought its reward in the established confidence in, and the greatly extended use of, road tars in the Union. Owing very largely to the availability of the material, an extensive road construction programme was entered upon in 1935, after a National Road Board had been constituted, designed to give the Union some 5400 miles of main roads. These new highways were put in hand early in 1936. During 1937–38 and 1939 the bitumenising of these roads went rapidly ahead, most noticeably so in the Transvaal, with local tar available, and in the coastal districts with imported bitumen. During 1940 war considerations retarded the tarring of many of the National routes, but the unqualified success that has attended the very many hundreds of miles of road tarring leaves no doubt that, be it sooner or later, when the war ends the completion of the tarring of the first 5000 miles of National highways will be carried out with all possible expedition.

Industrial Census

Preliminary figures for the census of industrial establishments in the Union in respect of business years ended during 1939 are now available. In comparison with the previous year, the number of establishments rose from 9825 to 9837, and the fixed capital of these undertakings mounted from £82,487,000 to £86,686,000. The number of Europeans employed dropped from 117,237 to 117,056, and that of others increased from 188,217 to 189,087. Wage payments rose from £36,971,000 to £37,711,000, the value added to materials used from £81,161,000 to £85,108,000, and the gross output from £165,860,000 to £172,764,000. The largest increase in value of production was in respect of electricity, which rose from £9,925,000 to £11,085,000.

Biggest Ship Built in South Africa

What is stated to be the largest ship ever built in the Union has just been delivered to the Department of Defence by her Cape Town builders. She is the 70ft. passenger vessel "Isie," named in honour of Mrs. J. C. Smuts, wife of the Prime Minister. She will operate between Robben Island and Cape Town docks. Accommodation is provided for fifty passengers and for a crew of eight. The "Isie" has a beam of 16ft. and a draught of 6ft. There are two commodious saloons below deck, so that passengers may travel in comfort despite the rough seas often encountered on the 7-mile trip between the island and the mainland. Hitherto, travellers to the island have had to make use of fishing boats and endure all the discomforts of open decks.

The vessel is fitted with two powerful motors, which will enable her to make the passage in 30 min. She is strongly built of Douglas fir, with frames of oak from South African forests. She is fitted with all conveniences, and will be equipped with radio. Her steering is hydraulic. The vessel was built in the inner basin; her completion was delayed through difficulties in obtaining delivery of some of the fittings from overseas. In a recent trial trip, attended by officers of the Fortifications and Technical Services Department, the "Isie" proved that she has remarkable qualities in heavy seas.

Coal Industry in the Union

Satisfactory conditions prevail in the Union coal industry, and given adequate truck supply there is every reason to believe that tonnages established in 1940 will be at least equalled, if not improved upon, in the current year. The demand for shipments of coal is heavy, although dispatches to Delagoa Bay are of necessity erratic, owing to the operation of the convoy system and to the constant diversion of ships. There has been a rise in working costs at all producing centres, ranging from 2d. to 3d. a ton, arising for the most part from causes which may be attributed to war conditions. It is anticipated that all collieries output capacity will be fully extended, and in regard to coke, the indications for the next two years are that the capacity of the producing collieries in Natal will be fully employed in meeting the demand.

War Factories in the Union

Some 600 South African factories are now producing war supplies. This information was given by Dr. H. J. van der Bijl, Director-General of War Supplies, when speaking at a luncheon at Pretoria at the end of May to members of the Select Committee on Public Accounts and leaders in the industrial and business world, who were visiting war factories. Later, they toured factories on the Witwatersrand. Dr. van der Bijl said the South African technicians now employed at various factories were doing better work than the foreigners imported originally. The Chairman of the Committee declared that they had that day seen Italian guns being refitted with parts destroyed before the guns were captured by the South African Forces. At some factories they had seen goods destined for other parts of the Commonwealth. An amazing war effort had been built up in eighteen months.

Steel Industry in Rhodesia

A movement for the establishment and State fostering of industries in Southern Rhodesia is gaining impetus in that Colony. One sign of this is a motion which was submitted to the Rhodesian Parliament in May. It reads: "That in the opinion of this House, it is essential that the pegging and registration of iron and coal claims within the Colony shall be immediately prohibited until a policy for the full development of the steel and iron industry has been undertaken by the State or by a public utility corporation controlled by the State."

The trade agreement recently negotiated with Australia is being strongly opposed on the ground that it constitutes interference with the prospects of the steel industry now operating at Bulawayo, which since its establishment four or five years ago has achieved considerable success.

All-South African Trolleybus

An all-South African double-deck trolleybus will be completed and put in service at Pretoria in the near future. Owing to export restrictions in overseas countries, the Pretoria City Council's transport department has been unable to import bus bodies, and serious difficulties are expected should there be no additions to the present fleet. The City Council, however, possessed a double-deck chassis, and after extensive trials it was ascertained that this chassis could still be used provided minor adjustments were effected. This work will be executed in the local municipal workshops. After this, the chassis will be taken to Johannesburg, where an all-steel body will be built by a firm there. The plans and specifications provide that only South African steel be used. All the upholstery is to be made of South African leather, and only South African labour is to be employed. If this work is successful, it will probably result in the establishment of a factory to build bus bodies.

Importance of Vereeniging

The industrial importance of Vereeniging, Transvaal, grows yearly, and with further big developments in view, expansion is likely to be accelerated in the near future. This has been due in part to the enterprise of the Vereeniging Estates Company, whose industrial interests include coal, steel, and brick and tile enterprises. An area of about 22,000 acres has been acquired for new works to be established by the S.A. Iron and Steel Corporation. The Corporation contemplates erecting a large steel works on the acquired land, which shall not be much behind the Pretoria steel works, and will engage in several branches not included in the existing works. The construction of a new power station on the Vereeniging Estates Company's property has made good progress, and the new Bertha incline shaft of the Cornelia South Colliery was started at the beginning of this year to supply the new station. The Union Steel Corporation's works has been run at full capacity during the year. The new works of the S.A. Iron and Steel Industrial Corporation will be situated 6 miles from the centre of the town. At the Vereeniging brick and tile works a new plant for the production of refractory goods of all varieties has been completed. The proposed new industries and extensions to existing ones will be of great importance to the future development of Vereeniging itself, and will bring great benefits to the farming community in the district.

Railway Record Earnings

Railway earnings are regularly reaching higher levels for each week, as compared with corresponding weeks in last year or any previous year. The highest weekly total so far reached has been £768,976, which was made in the week ended May 17th, and was £127,000 above the total for the corresponding week in 1940. Advances of £80,000 and up to £100,000 per week are quite frequent. These increases are found both in the outgoing and incoming traffic. The increases in the outgoing traffic are mainly in respect of coal, iron ore, manganese ore, military supplies, and general merchandise, while the increases in inwards traffic is mainly in respect of mining material, scrap iron, petrol, and building material. The increases in iron ore and manganese ore carried would be much larger, but for the fact that cargo space is very difficult to obtain. Passenger earnings would show a much greater increase than they do were it not that troops arriving in convoys at Union ports on way to one or other of the theatres of war are carried free when ashore—also by trams and buses. Earnings of the Union ports also show large increases, harbour earnings for the week ended May 17th amounting to £50,000 compared with £35,000 for the corresponding week last year.

Training for War Work

THE following leaflet, P.L. 92/1941, has just been issued by the Ministry of Labour and National Service:—

Training and Upgrading.—The supply of skilled engineers has long since been exhausted. It is amongst their own operatives that employers must look for the skilled labour they require. Experienced men in the shops must be upgraded to take on work to the limit of their capabilities and a regular system of training organised even at the expense of a temporary loss of production. Time spent by skilled men in imparting their knowledge to others will be more than repaid in the long run.

Upgrading Courses.—To assist employers in their own training effort, courses arranged by the Ministry of Labour and National Service are already in operation to train employers' operatives as setters (autos, capstans, millers, &c.), toolroom workers and other skilled grades. The courses are given in Government training centres, technical colleges and industrial

establishments where the equipment and instructors are available.

The Instruction is given by competent craftsmen with up-to-date experience of industry and what is even more important, with the ability and experience to impart their knowledge. The training is planned on practical lines and the concentrated course of instruction will equip a man to perform higher-grade work in the shortest possible time. The length of the course will vary according to the type of instruction given and will normally last a few weeks.

Financial Arrangements.—The employer under this scheme is enabled to get one of his skilled operatives trained to a higher degree free of charge, but the man remains on the pay roll of the employer and is paid his wages by him in the ordinary way during training. The man's return to the employer after training is provided for so that the employer can be confident that he will get the benefit of the training. Moreover, in appropriate cases the Ministry is prepared to provide limited financial assistance to meet expenses which the employer may incur owing to the man's absence. The employee gets trained to a higher degree of skill free of charge and would normally be paid his wages calculated on the average over the last four weeks, during the training period. Moreover, if, for the purposes of training, he is required to move to another district, his fare will be paid, and if he has commitments in his home area he is eligible for lodging allowances at the rate of 3s. 6d. per night on the same terms as transferred war workers. An employee attending a training course may receive any excess of fares over his normal daily travelling expenses which he may have to pay. On his return to his employer he will have a higher degree of skill than when he left and can therefore look forward to any increase of wages which may result from this.

Replacements.—Trainees from Government training schemes will be submitted if necessary to take the places of men undergoing training. These men and women have had a thorough training of several months and will prove a valuable addition to your labour force.

Effect of Training on Production.—It is recognised that the organisation of training within a works and the temporary loss of a good operative who is taking an upgrading course may result in some slight temporary loss of production, but the Admiralty, the Ministry of Supply and the Ministry of Aircraft Production recognise the importance of training if the expansion of the engineering industry is to be maintained and fully endorse all measures taken to increase the supply of trained labour even when this means some immediate reduction in output.

Other Courses.—Where any of the present upgrading courses do not meet an employer's needs the Ministry will make every effort to arrange an appropriate course.

To Employers.—If you are in need of skilled workers for setting or for toolroom work and are unable to train your own men, get in touch with the Divisional Controller of the Ministry of Labour and National Service for your area. He will give you further details and make all arrangements for the further training of your best operatives.

Addresses of Divisional Offices

London.—59–62, Queen's Gardens, Bayswater, W.2 (Tel. No., Paddington 7050).

Eastern.—Sidney Sussex College, Sidney Street, Cambridge (Tel. No., Cambridge 54411–54418).

Southern.—"Monksbarn," Cressingham Road, Reading, Berks (Tel. No., Reading 81651).

South-Western.—Parklands, Tyndall's Park Road, Bristol, 8 (Tel. No., Bristol 33084).

Midland.—281–289, Corporation Street, Birmingham, 4 (Tel. No., Aston Cross 3081).

North Midlands.—Castle Mount, Cavendish Crescent North, Nottingham (Tel. No., Nottingham 40048).

North-Eastern.—Coronet House, Queen Street, Leeds, 1 (Tel. No., Leeds 31571–8).

North-Western.—Sunlight House, Quay Street, Deansgate, Manchester, 3 (Tel. No., Blackfriars 8821).

Northern.—28, Great North Road, Newcastle-on-Tyne, 2 (Tel. No., Newcastle 26011).

Scotland.—44, Drumsheugh Gardens, Edinburgh, 3 (Tel. No., Edinburgh 2161).

Wales.—Dominions House, Queen Street, Cardiff (Tel. No., Cardiff 3834).

Old Cromptonians.—The Association of Old Cromptonians held its annual general meeting and luncheon at the Trocadero Restaurant, Piccadilly, London, W.1, on Thursday, July 31st. The President, Sir James Swinburne, F.R.S., was in the chair and some sixty members were present. As many Old Cromptonians, who number considerably over three hundred and ordinarily are to be found in every part of the world, could not be expected to be present at this year's reunion, the attendance was limited to those members living within convenient reach of London. During the luncheon a time-limited number of group-chats were enjoyed, in which old acquaintances and topics were revived. The toasts included those of "The 'Guv'nor,' the late Col. R. E. Crompton," proposed by Sir James Swinburne; "The President," proposed by Mr. E. J. Fox; and "The Company," coupled with the name of Mr. Frank Parkinson, proposed by Mr. A. E. Mohring.

Markets, Notes and News

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quantities are f.o.b. steamer

Neutrals' Steel Trade Problems

The *Foreign Commerce Weekly*, the organ of the United States Department of Commerce, contains some interesting references to the world's iron and steel trade. Hong Kong, for instance, it is stated, has brought into force a system of licences to control trade in iron and steel products. Licences will be granted only for material urgently required and essential to the war effort. This is limited to Services and defence requirements and the maintenance of public utilities and communications. Applications to import from India, Australia, Canada or any source outside the United Kingdom or the United States will be decided by the Government of Hong Kong. Where material is urgently required and cannot be obtained, applications to import from the United Kingdom or the United States will be referred to the British Secretary of State for the Colonies after provisional approval by the Hong Kong authorities. It will then remain for the British authorities to say whether it will be supplied from Great Britain or from America. The goods to which this Order is applicable include a long list of steel and metal products. In Manchuria the second five-year plan will shortly be adopted with a view to increasing Manchuria's production of iron, steel and coal. An attempt is also to be made to become independent of foreign imports of scrap iron and steel. It is also intended to make Manchuria self-supporting in the special steel and alloys which are not now being supplied by Japan, and at the same time Japan is to be supplied with large quantities of pig iron. Reports from Sweden indicate that the iron and steel industry is encountering increasing difficulties in obtaining adequate supplies of raw materials. These include coke, the lower qualities of pig iron, and scrap. Recent estimates by Swedish authorities, however, claim that the production of all the steel mills in 1941 will total between 800,000 tons and 850,000 tons of finished products out of a total capacity of between 900,000 tons and 1,000,000 tons per annum. Owing to war conditions the potential export demand for Swedish commercial iron is practically unlimited, but the country's ability to export is contingent upon imports of materials which can only be obtained from Germany. In the trade agreement between Sweden and Germany large quantities of commercial iron were included, but transport difficulties may considerably reduce deliveries of the stipulated quantities. The shortage of nickel and tungsten is another problem with which the Swedish industry is faced.

The Pig Iron Market

The pig iron market does not vary much from week to week. Now that the Control sees to it that practically the whole output is devoted to national needs business in pig iron is chiefly a matter of arranging priority deliveries. Conditions in the various districts may differ slightly owing to local requirements, but for the most part the situation is steady and satisfactory. Where rather stringent conditions rule the Control has taken steps to ease them by distributing imported pig iron. Tightness is chiefly noticeable in the hematite and low-phosphoric departments of the trade and is due to the heavy demand for these descriptions from engineering foundries engaged upon war work. In the case of hematite, supplies have been restricted for some time, but there are still stocks in the hands of the Control, and if the position needs watching the future outlook is not such as to cause concern. Consumers, wherever possible, are asked to use substitutes, and in this way the supplies of these irons are carefully conserved. Refined irons are in fairly plentiful supply, and these are used largely by ironfounders in their mixtures. The demand for high-phosphoric grades has become rather more pronounced lately, although there is little improvement to be seen in the requirements of the light castings industry. A wider use of this iron is being pressed on consumers by the Control in substitution for other classes of pig iron, and this has stimulated the demand to some extent. The Midland producers of high-phosphoric pig iron appear to be supplying districts that before the war drew their supplies from other sources, and the majority of them seem likely to be fully occupied for a long time. In Scotland the position has not changed much over the past few weeks. The demand for foundry iron is maintained and in some cases producers are experiencing rather heavy pressure for deliveries from consumers. Users engaged on essential work, however, receive their full supplies with regularity. The consumption of basic pig iron is upon an extraordinarily heavy scale, but the requirements of the steel works are being met. Large as are the needs of the steel makers, there seems no likelihood of any shortage developing.

North-East Coast and Yorkshire

A feeling of satisfaction is noticeable in the steel industry on the North-East Coast, and the belief is expressed that the industry is well on top of its major problems. The production of manufactured steel is on an impressive scale and there are signs that it exceeds the consumption in the case of a few descriptions. This, however, may be due to circumstances of a more or less temporary character and also to a liberal distribution of imported semis by the Control. Satisfactory as outputs have been, the stupendous demand for all descriptions of finished steel has been only fully overcome in one or two departments. The heavy production of billets plus the importation of large quantities of American material has brought about a notable change in the situation and has enabled most consumers to accumulate stocks. In this they have been supported by the authorities, who regard the holding of moderate stocks as a precaution against a slowing down of transport through winter conditions. For a long time the heavy rolling mills were kept working at top pressure, but for several weeks there has been a steady decline on the demand for the heavier sizes, and at some works an influx of new orders would be welcome. The country's requirements of sheets, also, have diminished and this has given the authorities the opportunity of concentrating industrial operations. Lately the sheet industry has been able to spare part of its output for requirements that for a long time have been relegated to the background by more urgent needs. There is a steady and vigorous call for plates, which are passing in large tonnages to the shipyards and tank builders and wagon builders; but the demand for heavy joists does not improve and constructional engineers are generally less busy than they were a few months ago, notwithstanding that many firms are working for the shipbuilders and fabricating material for assembly at the yards. In spite of the holiday breaks that were rendered necessary by the need to carry out repairs to plant, the production at the steel works in Yorkshire is maintained on a heavy scale. All the steel works have sufficient orders in hand to keep them busy for months, and most of it is work of high priority. There is a strong demand for alloy and special steels and probably the output of these descriptions is higher than at any time in the history of the industry. The requirements of the aircraft manufacturers are insistent and there is a continuous call for cold-rolled strip.

Copper and Tin

The British copper situation continues satisfactory, since, notwithstanding the enormous demand from the war industries, no complaints are heard from consumers of lack of supplies. The Control exercises great care in the distribution and all the firms engaged upon national work appear to be receiving their metal with regularity. This is also satisfactory, as it points to supplies reaching this country without interruption in spite of the German attempts at blockade. When Germany attacked Russia there was general expectation in the market that quantities of copper would be needed by the Soviet, but so far there has been no mention of copper being sent to that destination. In the United States the Control has become effective and it is difficult to obtain the metal for any purpose outside the rearmament programme. Prices in the United States are unchanged at 12c. for the domestic home market and 11c. for export. The latter figure, however, is nominal, since licences are apparently granted only to Great Britain and the British Commonwealth. Suggestions that the home trade price should be increased with a view to bringing into operation mines which have been closed down have not been well received by the authorities there, who seem determined to maintain prices at the 12c. level. In the conditions now ruling in the United States little information is available, since there are no dealings in copper on the New York Commodity Exchange and export figures are no longer published. It is believed, however, that the whole of the Chilean production is now going to the United States and this is quite possible, since the mines in that country are principally held by American interests. . . . There has been little alteration in the tin market. The turnover has been small and the price fluctuations have been narrow. During the whole of last week the movements were within 5s., although the market opened this week at 10s. above the price on the previous Friday. Steady quantities have been disposed of in the East, most of it going to the United States. No export licences are available in Great Britain, the evident intention being to build up stocks. It is expected, however, that so soon as the stocks have reached a satisfactory level the granting of export licences will again be resumed.

Lead and Spelter

The lead situation has not changed for some time and is regarded as being comfortable so far as this country is concerned. Supplies are arriving here with regularity and there is plenty of lead available for the war industries, notwithstanding the exceptionally heavy demand. The cable and battery makers continue to be heavy consumers. In the United States the demand for lead appears to be growing with the expansion of the defence programme, and it is agreed that the American domestic production will not be sufficient to meet the full requirements of the United States. Lead, however, can be obtained from Mexico, and the producers there will probably be glad to supply any quantities, since they are cut off by war conditions from many of their usual markets. According to American statistics, the receipts of recoverable lead in ore and scrap by the smelters in the United States in May were 48,000 tons, against 48,477 tons in April. Deliveries in May, however, reached the rather heavy total of about 90,000 tons. . . . The situation in the British spelter market is tight. The Control, by careful distribution, has the position well in hand and there are no complaints of consumers engaged upon war work having to go short of metal. The brassmakers are working at a high rate and there is little likelihood of any falling off in the demand for spelter from this direction for the duration of the war. On the other hand, the galvanising industry has become rather quieter and this must affect the spelter requirements of that trade. In the United States stringent conditions prevail in the spelter market and, generally speaking, the world position is far from easy. The American price is retained at 7¼c., but if it were possible to obtain spelter for export in that country much higher figures would have to be paid. India lately has been inquiring for spelter in Great Britain, the United States and Canada, but has found it difficult to cover her requirements. It is understood, however, that supplies will be provided for India by Australia.

Canada Seeking for Oil.—Extensive research is being undertaken on crude oil from Turner Valley, Alberta, as a source of toluene for explosives, while tests are being conducted on a number of new explosives and pyrotechnics that have been proposed for military purposes.

Notes and Memoranda

Rail and Road

For Lubricating Axles.—Extensive research has been carried out in India to determine what native vegetable oils can be mixed with mineral oils to produce good lubricants. The Director of Scientific and Industrial Research, in co-operation with an Indian firm, has prepared a mixed blown rape oil and axle oil combination, which has been found to be satisfactory for axle lubrication and is already on the market.

A Water Problem.—The Great Southern Railway of Western Australia has a large depôt at Katanning where water problems arise whenever a long dry season occurs. The railway requires 5,000,000 gallons of water per annum, and to meet the demand the Katanning Water Board has borrowed from the Treasury £20,000 for bituminising an area of 60 acres of the catchment to improve the run off into its main reservoir.

Oil-fired Locomotives.—The Egyptian State Railways is making experiments with fuel for locomotives, converting a considerable number to burn oil in place of coal. Experiments have also been conducted with cotton-seed cake as a locomotive fuel. Export of this commodity is difficult, and coal in sufficient quantity being almost unprocurable, what has been one of Egypt's source of wealth has become a source of power.

Mobile Laundries.—The popular mobile canteen is to be supplemented before the winter by a mobile laundry, the gift of the Associated Soap Manufacturers. The A.S.M. have decided to provide a fleet of twenty-four laundries, and Hull is to have the first of a batch of three. The donors have particularly asked for it to be attached to the W.V.S. The outfit comprises four washing machines and drying machines, electrically worked.

Cartography in Canada.—The Canadian Government will undertake this summer one of the largest geological exploration and topographical mapping projects in recent years. The area to be covered under the project will be 40,000 square miles in the region immediately to the east of James Bay, at the southern end of Hudson Bay. This will be carried out by the Mines and Geological Branch of the Canadian Department of Mines and Resources. Transportation of personnel and supplies will be by aeroplane.

Creosote-Petroleum as Fuel.—After extensive tests and road trials in Scotland it has been found that it is not practicable readily to adapt internal combustion engines to burn creosote neat. It can be used, however, in the form of a blend with normal petroleum. In one large-scale trial involving three omnibuses, and a total of 25,000 miles, it was ascertained that a mixture of 25 per cent. creosote to 75 per cent. petroleum oil ran satisfactorily, provided the blending was thoroughly carried out. In another instance a million gallons of a blend containing approximately 14 per cent. of creosote were used over a year in a transport fleet comprising several makes of engines.

What a Subway Entails.—At the end of last year there was completed the 2¾-mile Sixth Avenué subway, New York, which cost approximately 60,000,000 dollars. Its construction involved almost every known method of underground construction at different points along its length. The extraordinary variety and number of obstacles encountered in so short a distance accounted for a part at least of the cost. These obstacles in a single section of the work comprised fifteen gas mains, five water mains from 12in. to 48in. diameter, 250 cables carried in twenty banks, a 16in. steam main occupying a space of over 4 square feet, and fourteen manholes, each 10ft. square and from 8ft. to 10ft. deep. The problem was to restore all these within the limited space between the top of the subway roof and the street surface.

Tar Carpets and Dressings for Roads.—The Road Research Laboratory of the Department of Scientific and Industrial Research has just issued, in co-operation with the Ministry of War Transport, the first of a new series of publications entitled "Wartime Road Notes." The series will deal with subjects of particular importance in the war effort, so that those engaged on road construction and maintenance may be kept informed of the latest developments. Wartime Road Note No. 1, "Recommendations for Tar Carpets and Surface Dressings," H.M. Stationery Office, price 6d., deals, first of all, with tar carpets, and recommendations are given about the aggregate (including its grading), the filler, the binder, and the mixing and laying of the carpet. These are given for carpets using either crushed rock or gravel. The second part of the note gives similar recommendations on the components and method of application for surface dressings using tar binders. These recommendations are based on systematic full-scale trials undertaken by the Department of Scientific and Industrial Research, jointly with the Ministry of Transport and the British Road Tar Association, extending over many years and supported by laboratory investigations.

Air and Water

Aviation Plugs in Canada.—Mica for aviation sparking plugs has to be of special quality, and Canadian amber micas are being tested to prove or otherwise their suitability for this purpose.

The "Georgic."—The Cunard White Star Line states that s.s. "Georgic" has sustained some damage by enemy action, but with the exception of the chief bar keeper all the members of the crew are safe. There were no troops on board at the time.

A Californian Scheme.—Away over in the west of the United States a scheme is in progress for building a dam in the Sacramento River, alongside which for 37 miles runs the Southern Pacific Railway, between Redding and Delta. The scheme involves the inundation of a part of the section and a shortened diversion line, in which there will be thirteen tunnels and eight big bridges. The total tunnel length is more than 6000 yards, two being each 900 yards in length. The longest bridge is 720 yards long. The next longest, 600 yards across, spans the river at a height of 500ft.

American Shipbuilding.—Work in American yards has risen to the highest level since the 1914–18 years. Contracts held by plants throughout the country now total 6,000,000 tons. During May ten new vessels were completed, adding 80,101 gross tons to the merchant fleet of the United States, while twelve ships of 88,680 tons were launched and sent to the fitting basins.

The Purification of Water.—The U.S. Bureau of Mines has issued a preliminary report on researches on activated carbon from coal refuse. A good grade of activated carbon suitable for water purification can be made from a carbonised material high in ash, although the activity of the product decreases steadily as the ash content of the coal increases. So far, activation by steam and zinc chloride has been studied, but other chemical activators are to be investigated.

A New Use for Cellophane.—To ensure a thorough analysis of water flow through the penstock and spillway conduit of an eastern hydro-electric plant, the hydraulic laboratory of the Worcester Polytechnic Institute recently made and tested a scale model of "Lucite" which enabled the behaviour of the water to be observed at all points in its course prior to entering the water wheel. This material, a transparent plastic, is readily shaped and drilled and is pliable at about 240 deg. Fah.

To Cement Line Pipes.—When the American Association of Waterworks Engineers met recently in Toronto, the City Engineer of Toledo, Ohio, described in detail how a 48in. and a 60in. diameter steel main were lined with a ¼in. coating of cement. A specially designed electric lining machine was used, which was inserted in the main through an opening used for handling the cementing material. Highly trained men operated the device, which lined the 48in. pipe at a rate of 350ft. per day at a cost of 2·79 dollars per lineal foot. The record for the 60in. main was even better, with an average of 705ft. per day at a cost of 2·50 dollars per lineal foot.

Shipping for S.A.—The "Robin Locksley," the first of the six new cargo vessels to be built by the American Robin Line for the South African service, has reached Durban safely after her maiden voyage, a run of 18½ days from New York to Cape Town. The new vessel has a tonnage of 7101, a length of 470ft., a beam of 66ft., and a cruising speed of 15½ knots, with a maximum of 18 knots. She is of the single-screw turbine-driven type. It has also been announced that the American and South African Line hopes to reduce the run between New York and Cape Town to 16½ days by means of the three 17,000-ton vessels now under construction. These ships, which will be named "African Comet," "African Meteor," and "African Planet," respectively, will be the first all-welded passenger vessels in the world, and each will have accommodation for 111 persons. They will be combined passenger, cargo and refrigerator vessels and will cost a total sum of £1,025,000.

Miscellanea

More Power for Aluminium.—A new power installation of 700,000 H.P. is being established on the Saguenay River in Quebec for use of the Arvida aluminium plant.

S.A. Gold.—The S.A. Government is considering the establishment of a gold refinery in Southern Rhodesia. At present Rhodesia's gold output is refined in the Transvaal.

A Specialised Charcoal.—The Ministry of Supply has placed contracts for charcoal made from coconut shell with the Governments of Travancore and Mysore, and with a firm in Madras. Already about 6500 tons have been shipped from India. The difficulties encountered in manufacture have now been largely surmounted.

From Bauxite Waste.—The Department for Research of the University College of Science and Technology, Calcutta, has succeeded in recovering titania from bauxite muds by the employment of the semi-dry bisulphate process. The titania recovered contains a very small percentage of iron, which is finally removed by treatment of the precipitated titania by 1 per cent. of dilute sulphuric acid.

Directorate of Office Machinery.—The Board of Trade announces that a Directorate of Office Machinery is being set up in order to regulate supplies of home-produced and imported office machinery. The President of the Board of Trade has appointed as Director Mr. Geoffrey Cunliffe, a business member of the Industrial and Export Council. He is at present engaged in exploring the position in conjunction with the trade and other interested bodies.

Copper in the Philippines.—The "flare-up" in the Far East has directed attention to the Lepanto copper mine in the Mancayan-Suyoc district of Mountain Province. Apart from the three leading Japanese copper mines, Mitsubishi, Sumitomo and Furukawa, it is easily the most important copper producer in the Far East. In 1939 the Lepanto mine had an output of over 4000 tons of metal. At its present rate of production that output should be considerably increased.

Fire and Aluminium Paint.—The Safety in Mines Research Board, at the request of the Factory Department of the Home Office, and on the initiative of the Association of British Chemical Manufacturers, has investigated a hitherto unnoticed possible danger in mines, and the experimental findings have been published. They indicate that danger may arise from the ignition of inflammable mixtures by the sparks or flashes when aluminium-painted rusty ironwork is struck or scraped with a metal tool. Copies of the report are not being made available for sale, but any firm interested can consult a copy of the original report on application to the Superintending Inspector of Factories for its district.

Canadian Metals.—Canada, says the *Chamber of Commerce Journal*, has almost a world monopoly of nickel, and her current output is estimated to be approaching 90 per cent. of the world's total production. It is expected that during 1941 Canadian production will reach 125,000 tons. In a favourable year Canada produces over 400 million pounds of lead, almost the entire production coming from British Columbia. Newfoundland has also a well-developed lead-zinc mine and a quantity of pig lead is exported.

What the Black-out Saved.—On June 18th last Toronto had a test black-out, which is reported to have been more effective than any in this country. At 10 p.m. the load on the municipal system under test was about 170,000 kW and had already begun to show signs of decrease below normal. By 10.15 it was down to 160,000 kW and at 10.30 it was 69,500 kW. It stayed at this value during the fifteen-minute black-out period and at 10.45 began to increase sharply to an 11 p.m. value of 163,000 kW, slightly above normal.

The Late Mr. Arthur Chamberlain.—We regret to have to record the death of Mr. Arthur Chamberlain, at his home, Rackenford Manor, Tiverton, on Thursday, August 7th. Mr. Chamberlain was sixty years of age and his death occurred suddenly. He was a cousin of the late Prime Minister. In 1918 he joined the board of the General Electric Company, Ltd., having been associated with the firm of Chamberlain and Hookham, Ltd., Birmingham, which was absorbed by the G.E.C. at that time. Mr. Chamberlain was also a director of a number of other well-known industrial concerns.

Monel "Doctors."—The razor blade "doctor" is a recognised means of removing surplus ink or oil from rotating cylinders. An example is that of soap drying drums. Made of steel, it may be necessary to stop the machinery for ten minutes in each eight-hour period, in order to hone the blades. This ten-minute stoppage entails a production loss and one soap factory has adopted doctor blades of heat-treated "K" Monel. At the end of 188 hours of continuous operation with the new type of blade only two honings had been required.

The War and Overseas Enterprise.—New industries are springing up in the Dominions and Colonies. By way of example India now has more than a dozen paint factories using indigenous raw materials and operating on modern lines. These are producing dry colours, paste paints, mixed paints, enamels, varnishes and oils from cheaper qualities to meet the demand of the Indian bazaars to the production of highly specialised qualities for use by railways, shipping and industrial organisations. They can also manufacture paints required for war purposes, including anti-vesicant, camouflage and fire-retarding paints.

Personal and Business

Mr. W. H. Bowley has been appointed a director of Ambrose Shardlow and Co., Ltd., Sheffield.

Mr. A. E. Morrison has been appointed managing director of Moore and Wright (Sheffield), Ltd.

The Minister of Supply has appointed Mr. Giles Newton to be Controller of Inspection (Administration) in the Ministry.

Mr. E. H. Cooper, chairman of Gillette Industries, Ltd., London, has been appointed War Production Adviser for Northern Ireland.

Mr. A. Kirkwood Dodds, of L. G. Mouchel and Partners, Ltd., has succeeded Mr. Douglas H. Green as Chairman of the Council of the Reinforced Concrete Association.

Petters Ltd. informs us that its London office has been reopened at Bush House, North-West Wing, Aldwych, W.C.2. Mr. A. P. Quarrell, A.M.I. Mech. E., is resuming his duties as London manager.

The Brush Electrical Engineering Company, Ltd., Loughborough, informs us that its London office and that of Brush Coachwork, Ltd., have been moved from 88, Kingsway, to Bush House, North-West Wing, Aldwych, W.C.2.

We regret to record the death, in his sixty-fifth year, of Mr. C. H. Cox, for nineteen years a director of the Edison Swan Electric Company, Ltd., and also of Edison Swan Cables, Ltd. Mr. Cox joined the Edison and Swan United Electric Light Company at Liverpool in 1894, serving under his father, on whose appointment as inspector of the company's depots Mr. Cox was made manager of the Liverpool branch, a position he held for ten years. In 1921 he was appointed commercial manager and later elected to a seat on the board. Mr. Cox was one of the oldest members of the E.L.M.A. Council.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

Institute of Metals

Thursday, September 4th.—Junior Institute of Engineers, 39, Victoria Street, Westminster, S.W.1. "Developments in Powder Metallurgy," W. D. Jones. 6 p.m.

Manchester Association of Engineers

Monday, August 18th.—College of Technology, Manchester. "Psychological Factors in Accident Causation," C. A. Oakley. 7.30 p.m.